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AGRICULTURAL ENGINEERING

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A Message from America's Five-Star Generals and Admirals

TO THE AMERICAN PEOPLE:

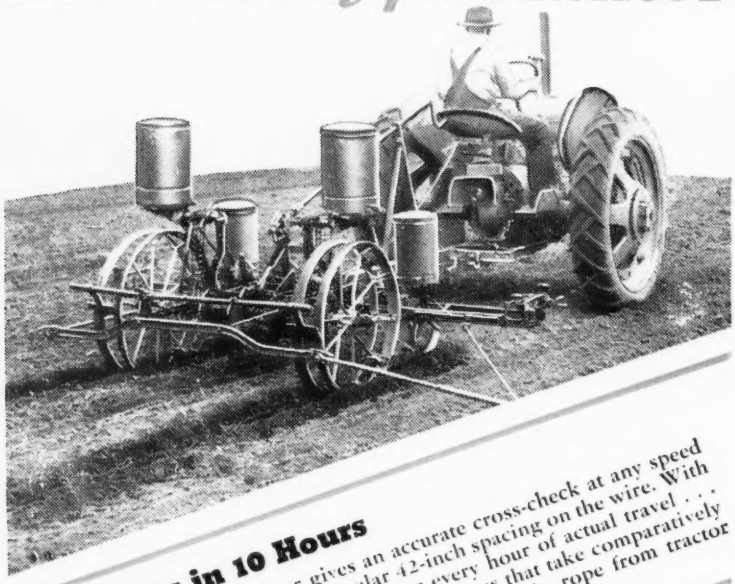
Your sons, husbands and brothers who are standing today upon the battlefronts are fighting for more than victory in war. They are fighting for a new world of freedom and peace.

We, upon whom has been placed the responsibility of leading the American forces, appeal to you with all possible earnestness to invest in War Bonds to the fullest extent of your capacity.

Give us not only the needed implements of war, but the assurance and backing of a united people so necessary to hasten the victory and speed the return of your fighting men.

THE JOURNAL OF THE AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

Something New
in a *Pull-Type* Planter



• • 30 Acres in 10 Hours

This new No. 45 Case planter gives an accurate cross-check at any speed up to 100 buttons a minute with regular 42-inch spacing on the wire. With rows 42 inches apart, that's 3¼ acres for every hour of actual travel . . . 30 acres every 10 hours in fields with long rows that take comparatively little time for turning. Power lift, controlled by trip rope from tractor seat, and automatic features speed up the turns, too.

• • Drops Hills on a Dime

Secret of this planter's accuracy at fast speeds is mainly in the new bottom valve, so built that kernels can't bounce around and string out while being released. Instead, they are held in a bunch and pushed out close to the ground. Pole adjustment provides for lining up the drop with the button with any model of tractor. The time-proved Case design of plate and box-bottom assures accuracy of kernel count.

• • Accurate Depth Control

Crank-screw depth adjustment gives exact depth desired. Crank position adjustable for handy operation from seat of any tractor. Permits raising runners a little in soft spots, setting them deeper in dry soil, all without so much as slowing down. Regardless of planting depth, power lift raises runners to full high clearance; also releases wire and throws drop out of gear. Markers shift automatically while turning.

• • Works Behind Any Tractor

The new Case No. 45 planter hitches with a single bolt to any size, make or model of tractor. It has no parts mounted on or driven from the tractor; just unhitch and tractor is ready for other work. Check-heads are set out wide; wire clears wheels of any tractor. Wire reel, carried on planter, has level-winding device to guard against catching and kinking when wire is laid out again. Plates available for every grade of hybrid corn.

Freeing the corn-grower fro
former speed-limits in chec
row planting, this new Cas
planter offers him four-row
capacity with two-row com-
pactness, convenience and econ-
omy. By breaking one of the
last bonds to the pace of mus-
cle-powered farming it brings
closer the day of a truly en-
gineered agriculture. You are
invited to use Case educational
movies and bulletins on terrac-
ing, contour tillage, making
high-protein hay, and other ad-
vanced farm practices.

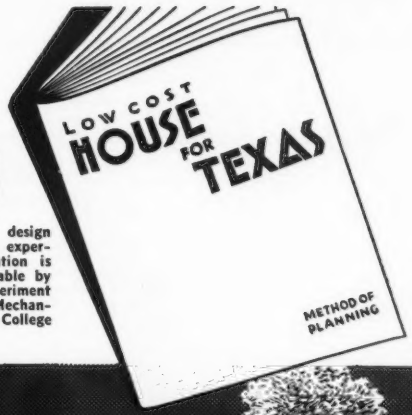
J. I. Case Co., Racine, Wis

★

★ ★

CASE

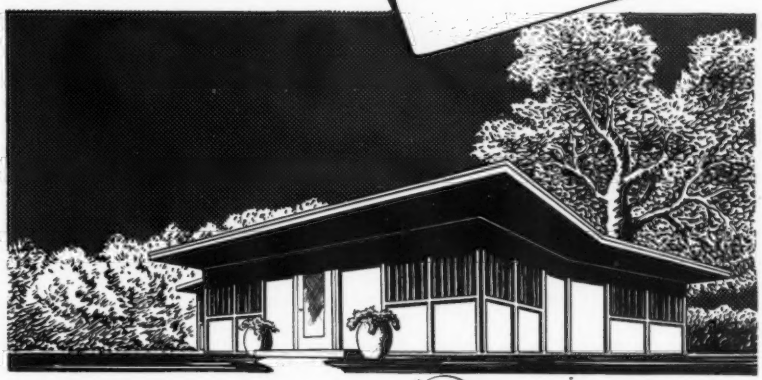
Low-Cost House for Texas



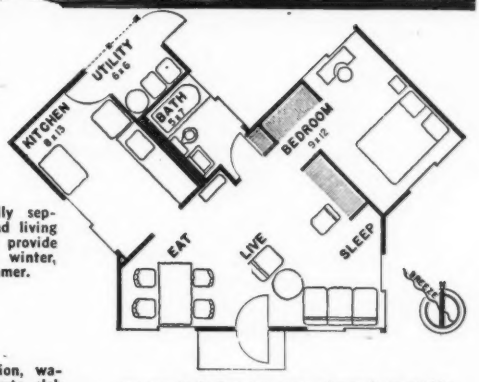
A complete discussion of design considerations, construction experiences and interior decoration is given in Bulletin 76, available by writing: Engineering Experiment Station, Agricultural and Mechanical College of Texas, College Station, Texas.

To answer the question as to the kind of a house desired by low-income Texas families, whose annual earnings might range from $1000 to $1500, students in architecture at the A & M College of Texas and students in fine arts of the Texas State College for Women spent two years designing and building a house on the college campus at Denton. Erected by representative building mechanics under a conventional contract at a cost of $1705.64, the house is in no sense a "model" house. Rather,—"it was designed to meet the needs of an average Texas family with a limited income. It is an effort to develop new forms which will meet the needs and habits of this family, and to find the most economical materials that are available today."

Following a survey of the inadequate housing currently provided for the low-income group of citizens, and of the unimaginative approach to the construction of such homes, the students set up the fundamentals of the problem. For an average family of four members, living in a typical small town they set $2000 as the maximum which could reasonably be spent for a house. Studies were made of the four main family activities—eating, sleeping, working and playing — which, with subordinate activities varying with individual families and community customs, made up the pattern of living for these families. Cooperating housewives kept time charts which gave a basis for determining the correct size of activity areas. Texas weather made the major climatic consideration one of protection and comfort during the long, hot summers. The orientation of activity areas and the structural design were selected to give protection from the sun and to take advantage of any breeze. Site locations to provide ready access from the street, garden areas, and availability to the conventional home services and utilities entered into plan decisions. The Y-shaped floor plan, single-thickness plywood wall and flat roof which finally evolved on the drafting board had the final merit of providing for expansion very easily.



Exterior type Douglas fir plywood (made with completely waterproof resin binder) was used for walls, roof and other construction details in building this modern, attractive farm home.

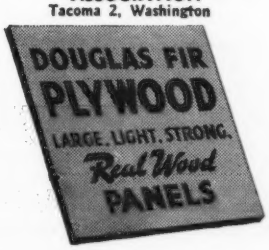


The Y-shaped plan ideally separates working, playing and living areas, and is designed to provide maximum sunlight in winter, maximum coolness in summer.

BRIEF SPECIFICATIONS

FLOOR—Three inch pea-gravel cushion, waterproofing felt, 3" reinforced concrete slab leveled and troweled to a smooth finish.
EXTERIOR WALLS—A 2x6 inch plate, shaped to go under plywood wall to form interior base mold, and bolted to slab in mastic. Paint-primed 2x4 inch studs 4 feet o.c. Single 2x4 inch plate. One-half inch Exterior type plywood nailed and glued with water-resistant glue to inner face of studs and sealed at bottom into sole plate with a waterproof mastic.
INTERIOR PARTITIONS AND CEILINGS—One-quarter inch Moisture-Resistant type plywood nailed both sides of studs and beneath ceiling joists.
WINDOWS—Two sash, one light each, fitted between studs with one sash fixed and the second free to slide horizontally on gliders on window sill. Beaded window stop screwed to head to allow sash to be removed for cleaning. Galvanized wire screen tacked to studs.
ROOF—Pre-cut 2x8 inch ceiling joists spaced 2 feet o.c. One-half inch Moisture-Resistant plywood roof sheathing covered with three-ply felt, asphalt and pea gravel. Galvanized sheet steel gravel strip around roof edges. Soffit of roof overhang covered with one-quarter inch Exterior type plywood to within 4 inches of top plate; 4 inch opening screened for continuous roof vent.
PLUMBING—Cast iron sewer line laid beneath floor slab. Water and gas connection brought in above slab and all interior piping except to stove concentrated in one interior wall.
WIRING—Romex wiring through joists to ceiling outlets, and between partitions to service outlets.
PAINTING—Concrete floors finished natural color with three coats heavy traffic wax. Exterior walls painted three coats gray-green exterior house paint to avoid glare. Soffit painted bright yellow to reflect light into rooms. Interior walls and ceilings given wiped coat of white pigmented resinous sealer and waxed. Bath room painted two coats yellow gloss enamel.

DOUGLAS FIR PLYWOOD ASSOCIATION
Tacoma 2, Washington



GENUINE DOUGLAS FIR PLYFORM Concrete Form Panel D.F.P.A. INSPECTED
GENUINE PLYWALL Douglas Fir Plywood WALLBOARD D.F.P.A. INSPECTED
SPECIFY DOUGLAS FIR PLYWOOD BY THESE "GRADE TRADE-MARKS"
PLYPANEL D.F.P.A.
EXT.-D.F.P.A.
GENUINE PLYSCORD SHEATHING D.F.P.A.
Farm Buildings are War Equipment. . . Keep Them Fit and Fighting

AGRICULTURAL ENGINEERING

Established 1920

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EDITORIAL

Against Appeasement

IN several ways the paper by W. Forrest Smith, published as the leading article in this issue, strikes us as one of the most constructive and certainly the most thoroughly American document that has come to our notice in the realm of soil conservation. First is his forthright refusal to accept appeasement of erosion. He has no patience with expedients that rescue only a fraction of the soil from robbery by rain.

Mr. Smith boldly tosses his hat into the ring in behalf of private business in competition with governmental agencies and the amateur efforts of farmers to build their own structures for soil and water conservation. This is entirely constructive and inspiring. Such rivalry in good works should stimulate every type of agency to improve its techniques, reduce its costs, and step up its sales efforts. Such competition means concerted attack on a problem, greater speed in achieving the blessing of its solution. If aggressive commercialism can do for terracing what it has done for hybrid corn, it will earn the eternal gratitude of agriculture and of America.

In the shorter view, commercial conservationism is full of promise for the reconversion to peace. It should make a market for much of the military earth-moving equipment which will become surplus government property at the end of hostilities. It should furnish employment for many veterans who have been trained in the use of this equipment. In Mr. Smith's opinion it creates opportunities for hundreds of small businesses and positions for many agricultural engineers. As a man who has made a success of such business for nine years his opinion should carry weight.

Most important in relation to impending postwar problems, commercial conservationism will not be a further drain on the public treasury, but the kind of business that pays taxes as well as wages. It is the kind of business which does not advance by education and propaganda alone, but adds to them the power of advertising and salesmanship to hasten adoption of the blessings which it offers.

Chore Power

IN a communication to Chairman Leslie E. Hazen of the A.S.A.E. Committee on Postwar Objectives, Past-President Geo. W. Kable mentions the probability that in the decade ahead many farmers will have a hard time to carry on, and that the problem will be mainly that of getting costs down in line with prices. As in the past, the solution probably will come by greater and better use of power to multiply the productivity of labor. But in Mr. Kable's opinion it is a new place that power is most needed. He says "Field power is being increased and taken care of very well, but chore power is still lagging behind."

War experience supports Mr. Kable's view. In general we have had no serious shortages of corn, wheat, hay, or any of the foods or feeds grown with machinery in the open fields. Shortages have occurred and seem to be increasing in animal products. If we can ignore for the moment the impacts of economic tinkering, it seems obvious that the bottleneck lies in the conversion of feeds to milk and meat. Care of livestock is chores, and right there is where the scarcity of competent farm help has pinched the hardest.

Just as the internal-combustion engine is the foundation stone of field power, so must chore power look to the electric motor. It may be well to emphasize this concept. Otherwise the chore-boy, animal-husbandry services of electric light and heat may seem to excuse the paucity of our progress in feed-handling, refuse-removal and gate-swinging. As long as the average barn embodies fewer electric motors than the family flivver, when it might well have as many as a bomber, we have not really started farm electrification.

With electric energy already supplied to nearly half of America's farmsteads and plans afoot to double that number, the door of opportunity stands wide open. The power is generated and delivered. All manner of motors and magnetic devices are available, though often at too high a cost. In general the electrical engineer's job is pretty well done. From here on the problem is tossed into the lap of the agricultural engineer and of that considerable inventor, the American farmer.

Mr. Kable looks for the next decade to be the greatest in history in the development of new farm machines, born of the minds and hands of men trained along mechanical lines in the armed services. He suggests that all agricultural engineers keep watch for every such development and report it to A.S.A.E. headquarters, in order that it may receive such notice as will further its own flowering, if it be worthy, and in any event to add its contribution to the experience of the profession.

We invite such reports, preferably with photographs, in form suitable for publication and with due regard for limitations of space available in these pages. Wherever feasible such reports should give credit for originality, especially where there is possibility that it may constitute invention.

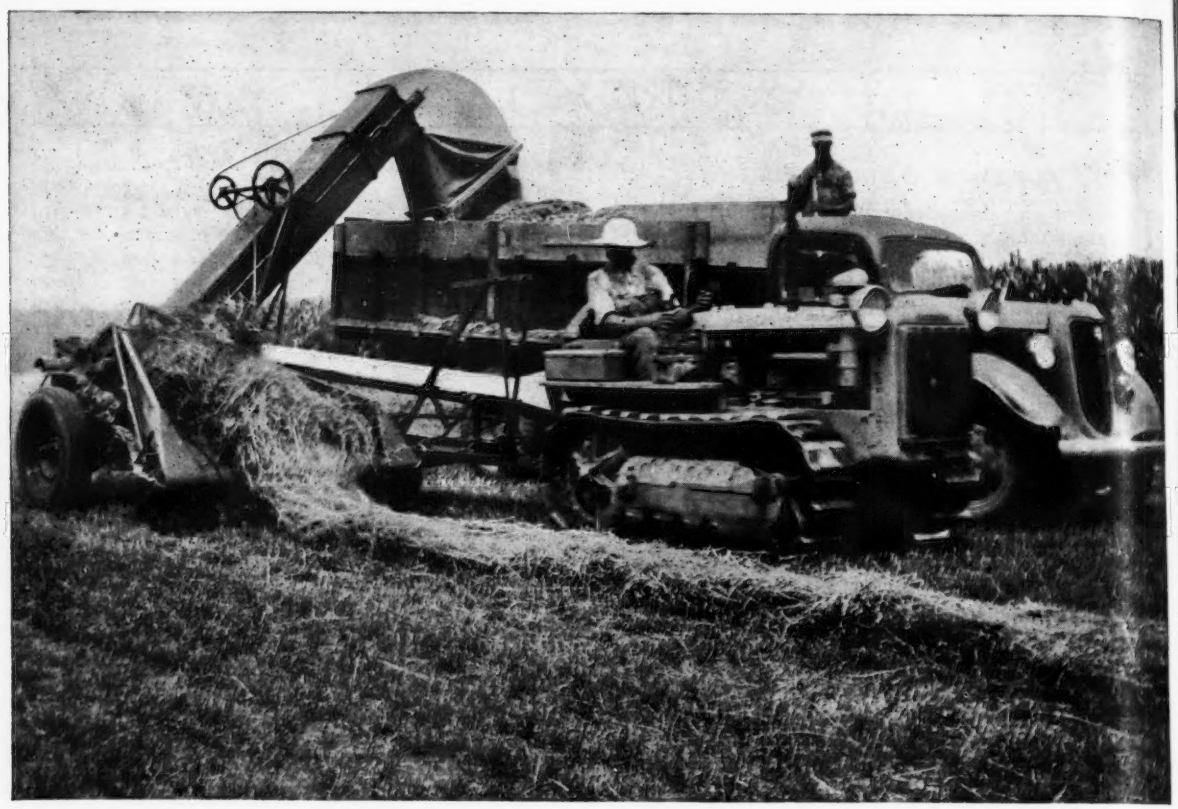
Red Schoolhouse Ceiling

SOMETHING of a shock came to us on seeing a tabulation of "median school years completed by rural farm people 25 years old and over," based on the 1940 census. The median value for native white people in the whole continental United States is only eight years of schooling, and for all classes combined the value is slightly lower. Only Massachusetts, Nevada and Utah have a figure of nine years or more.

This means that half the farm folks past the age of 25 never got past the little red schoolhouse, and that for every one who advanced beyond it there is another who never so much as got through it. Little wonder that we make slow progress in selling the blessings of Btu's and kva's to the people we serve and love. Similar must be the discouragements to those who deal in soil pH and chromosomes. We dissipate too much of our energy in trying to do by extension methods what should have been done more easily and more thoroughly in high school.

Far be it from us, with a background of farm birth and boyhood, to minimize the value of farm rearing and experience. But the time has passed when men learn medicine by reading in a doctor's office, or become lawyers by being office boy in a law office. Surely the time is at hand to rescue our national heritage of soil from a stewardship of which at least half has had not even an elementary course in chemistry, physics, or biology.

Admittedly, agriculture is perhaps the most complex of industries, in which no operator could possibly learn all the technologies. Perforce farming must be served by agronomists, geneticists, agricultural *(Continued on page 264)*



Trading Diesel fuel for sweat!

HERE'S a picture of manpower and man-hour conservation that's in step with the times!

It shows how Wiest Brothers, Le Sueur, Minnesota, trade Diesel fuel for sweat—eliminate the back-break and muscle-ache from "putting up" alfalfa hay!

With the Diesel D2 Tractor powering their 20-inch pick-up cutter, they can put 6 to 8 tons of cured, chopped alfalfa per hour on the trucks. With a corn ensilage attachment, they produce about the same hourly tonnage of silage!

The Diesel D2 burns only 12c worth of No. 3 furnace oil to do this heavy work. Machinery operators make up the crew. Doing the job speedily reduces the time between mower and haymow—thus helps make better hay. There's also more time left to diversify—and live!

Machines that do this and all such heavy-duty farm jobs can count on valiant team-work from "Caterpillar" Diesel Tractors. These sure-treading tractors that turn so much of their power into useful work—and Agricultural Engineering Development—both are traveling in the same direction!

CATERPILLAR TRACTOR CO., Peoria, Ill.

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The discharged veteran wears this emblem. Remember his service and honor him.

AGRICULTURAL ENGINEERING

Vol. 26 JUNE, 1945 No. 6

Postwar Opportunities in Land Terracing and Related Construction Work

By W. Forrest Smith
MEMBER A.S.A.E.

THE postwar period offers great opportunity for jobs, even privately owned companies, to thousands of men with experience in engineering and construction work. I have owned and operated a private business in Shelby County, Kentucky, for many years, a county located in the bluegrass section of the state and largely in an agricultural area.

In our county we protect everything but our land and have everything under control except the runoff from our annual rainfall which is approximately 42 inches. Rains that are intended as showers of blessing become instruments of destruction because we have not been versatile enough to stop water from running down hill. Soil erosion is our farmers' worst enemy. We have been fighting it since 1936, but at the present rate of progress we can never win a decision, and what remains of our heritage, the soil, will surely wash away unless there comes an awakening among more of our citizens before it is too late.

A brighter side of the picture is the probable expansion of the program we now have in operation. In 1935 the U. S. Soil Conservation Service established a CCC camp in the county. During that year our Farm Bureau organized a cooperative and purchased power equipment to engage in a farm reservoir and terracing program. The SCS and the cooperative worked together on the project. The camp personnel routed the equipment and did the engineering work. In April, 1937, the SCS withdrew its services and went all out for a program of stripcropping. This did not prove successful, but terracing under private management continued to expand; the Forrest Smith Terracing Company is the outgrowth of the cooperative.

From the beginning of the program to the present time farmers have invested $203,000 in terracing, farm reservoirs, lakes, smoothing gullied areas, grading roads, clearing fence rows, basement and cistern excavations, and other related projects. Profits accruing from this work have often been fabulous. A widow who makes her living by keeping convalescent patients owns 17 acres of land which had lain idle for years. She hired a reservoir dug at a cost of $36 and received $320 in pasture rentals during the next four years.

In August, 1940, a farmer seeded a 10-acre field to alfalfa and failed to get a stand; he failed again in April, 1941. By the last of May it had eroded beyond his ability to repair it with farm machinery. We terraced the field and filled in the gullies at a cost of $100. Subsequent rains saved a portion of the last seeding and during 1941, 1942, and 1943, the farmer harvested $1,260 worth of hay. I have no record of the 1944 yield. This field worth about $1,500 was saved for agriculture and goes into cultivation this year.

A former county agent who has protected his entire farm places a minimum value of $50 per acre on his terraces. One of our best customers, who has terraced 2,200 acres, would not consider cultivating unprotected land.

Ours is not a success story, because after nine years of work we find that our program is still in its infancy. It does, however, indicate a trend and offers postwar possibilities for jobs and equipment to an extent that few people have ever imagined. There are construction projects waiting to be started in every agricultural county having rolling land that can be estimated at approximately 25 per cent of the value of the land. These projects will require several generations to complete, because only about 2 per cent of the farmers grasp the advantages of the program each year, and each farmer has some work to be done annually for about ten years. An aggressive Farm Bureau organization and an active county agent can put a program into operation in any county after the war.

(Top) Tobacco growing on a Shelby County (Kentucky) field that has been protected from soil erosion by terracing • (Bottom) This picture gives some idea of the soil loss from a Shelby County tobacco field as the result of a single rain

While we are not yet winning the battle against soil erosion, I can report that we do have the *solution* to the erosion problem and have it working satisfactorily on 6,000 acres of the best land in Shelby County. It is the broad-base terrace skillfully laid out and properly constructed, followed by contour cultivation and good agronomy practices. If we can make three times as much progress in the future as we have made in the past, we will begin winning the battle in 1982. On that date 51 per cent of the county's land that is plowed will be *protected* land.

Our setup is what might be called a three-way cooperative. The Forrest Smith Terracing Company does the engineering and construction, the farmers pay the cost, and the county agent advises on good agronomy practices and crop rotations. No government agency nor farm organization is taking part in the program and

This paper was prepared expressly for AGRICULTURAL ENGINEERING.

W. FORREST SMITH is owner of the Forrest Smith Terracing Company.

all applications for work are voluntary. We have completed 2048 construction projects since the beginning of 1936, of which 1600 have been reservoirs and lakes and the remainder terracing and miscellaneous projects.

Participating farmers range from the largest to the smallest and include several financed by the Farm Security Administration. We sometimes hear it said that many farmers cannot afford to protect their land from erosion. This is an unsound argument. The farmer cannot afford *not* to protect it! In addition to this, ownership of land carries with it the obligation to protect it, and the banker or financial organization that loans money to buy land will loan money to save land. They just have not been approached upon the subject.

Next to winning the war, the most important problems facing the United States today are soil conservation and flood control. As we solve our soil erosion problems we are at the same time solving our flood control problems. It is apparent that dams across rivers and flood walls around towns constitute only a part of the flood control job, which can never be completed so long as millions of tons of soil are allowed to wash into the streams each year.

One may travel north, south, east, or west from Shelbyville, Kentucky, or any other city or town in a rolling agricultural community and search in vain for a field that has escaped the visible scars of erosion. This situation presents a challenge to the public that we have not yet begun to meet. A somewhat similar challenge faced the medical profession many years ago when the dread disease of smallpox ravaged communities, killing many and leaving pit marks upon the faces of all who survived it. Doctors did not rest until they had it under control. Had they failed in the attempt and every human being had to carry the scars through life, I wonder if such a situation would be as grave as our gully-scarred land. In a few brief years a generation passes on but the good earth was intended to go on supporting its inhabitants until the end of time.

Students of agriculture have realized for years that we were rapidly losing our soil, but they have not believed that it was so serious as to warrant a construction program. During this period they have been advocating contour cultivation, cover crops, strip cropping, a grass type of cultivation, proper land use, the application of lime, phosphate, fertilizers, and the seeding of legumes to check erosion. It now develops that checking erosion is not enough, and the trend is toward a combination of practices that *stops* erosion.

Dr. Thomas P. Cooper, dean of agriculture, University of Kentucky, and director of the Kentucky Agricultural Experiment Station, in a report to the representatives of the sixty odd members of the organizations of the Committee for Kentucky said, "Half or more of Kentucky's farms need to be changed from 'poor land' farms to 'good land' farms. Millions of acres are involved, and the people who live on them will fare poorly until the soil is improved and erosion controlled." No statement could be more timely or true, and the fact that our state college of agriculture is aware of the dangers that confront the state through soil losses gives added assurance that we will eventually find the answers.

While no combination of farm practices will ever be 100 per cent effective in stopping soil erosion, we have found the program our company is carrying out does put an end to gullies and is better than 95 per cent effective in stopping sheet erosion. The 5 per cent is not a loss, but a movement that occurs between terraces on fields where most of the top soil had gone before terracing was done, and during flash floods and "once-in-ten-year-frequency" rains. Most of this movement stops at the terrace channels.

It is possible to change "poor land" farms to "good land" farms and deepen the soil, only when we retain what we put on the land and keep what soil is left from washing away. Terracing and its "allies" do just that, and, with reasonable maintenance, the combination we are using looks like the answer.

Of all the agronomy practices mentioned in this paper, contour cultivation has been depended upon to protect the land from the time crops are planted until a cover crop finally covers it. In the steeper parts of the county where a modified form of contour cultivation has always been practiced (i.e., contour planting by eye), it has failed completely, and two-thirds or more of the soil has gone. On the more moderate slopes, square cultivation is so deep-rooted among farmers that the broad-base terrace has been the only means of getting them to change to contour cultivation.

Without terraces to guide them, it is necessary for the farmer to stake guide rows each year, which requires two or more men during the busiest season. Crops must be planted before a rain or before Saturday night, so contour planting is passed up until a later date which never arrives. If the 1800 farmers in our county would adopt the practice, erosion could be reduced perhaps 50 per cent. If one-half of them adopted it, we would get a 25 per cent effectiveness. If this half staked only half enough guide rows, the effectiveness would be reduced to 12½ per cent and would therefore not be worthy of serious consideration. The fact is that during about twenty years of recommending the measure not more than a dozen farmers of this county are attempting it. The practice loses its identity before the field again goes into cultivation, and each year the whole procedure must start from scratch. Unless we pursue control measures that are permanent, whereby each year's program adds to a previous total, we can never finish the job.

There is such a thing as completing an erosion control program. We have individual farmers who are doing it each year. We have been the only professional group in existence that has been content merely to slow down the evil that besets our clients. How long would the USDA Bureau of Animal Industry, for example, continue to recommend a vaccine for hog cholera that was less than 20 per cent effective? How long would a manufacturer of wire fencing stay in business if he turned out fencing that merely slowed down livestock? We can never save the last half of our soil by continuing the practices that were used while we were losing the first half. Unless we do go "all out" on a program that really stops erosion we are doomed to failure.

Shelby County had about 30,000 acres of land in cultivation in 1944. Twelve hundred acres was terraced land and was contour cultivated. It is the punishment that the 28,800 acres took while wide open to erosion, from the time it was disked in April until a cover crop finally covered it, that is distressing. This goes on each year and will continue until finally stopped by the terracing program.

Soil conservation districts have been established in about fifty of Kentucky's counties. Many believe that, when a district is established in a county, their soil erosion problems are practically solved. This is not the case, for after all private industry must

(Left) A bar of top soil 25 by 35 by 3 feet deep washed from a Shelby County corn field • (Right) This picture shows excessive loss from soil erosion on one Shelby County farm

eventually do the job. Districts may promote the work and lead the way, but it is not the intention of the USDA Soil Conservation Service actually to attempt to terrace every farm. I observe that at the present time their program is largely one of agronomy. Some of the goals for the Spencer County district for this year are as follows:

(a) 200 farmers using 10,000 tons of lime. (They will lose, through erosion, much of this lime and about 90,000 tons of soil.)

(b) 500 farmers using 200,000 pounds of phosphate. (They will lose through erosion much of the phosphate and about 450 million pounds of soil.)

(c) 50 farmers to fertilize corn fields using at least 250 pounds of complete fertilizer per acre. (They will lose through erosion much of the fertilizer and about 45,000,000 pounds of soil.)

The estimated soil losses, indicated in parenthesis in the three preceding paragraphs, are based upon each farmer having 15 acres in cultivation and losing 30 tons of soil per acre. That is certainly a minimum loss to be expected in that county.

If those who plan such programs would compare the amount of materials they suggest putting on with what washes away, they would surely recommend ways of keeping it on the land. Is it good business to keep putting lime and fertilizer on fields, knowing all the time that it is washing away with every rain, and knowing, too, that for each ton of materials applied about five times that amount of the real stuff, the soil, washes away never to be recovered? Would we keep on pumping water into a city reservoir if a large portion of it was being lost through the intake pipe and the reservoir was leaking five times faster than the pump could deliver the water? Would we continue putting money into a checking account if the banker confiscated 20 per cent of each dollar deposited and five dollars from our time-deposit account?

What is the answer to these questions? I believe it is a recognition that agronomy practices alone will result in complete soil depletion; that they are temporary conservation measures to be continued while construction programs are rushed to completion. Every slope of more than 75 ft in length that has been or will be cultivated should be protected by terraces. Related work as mentioned in this paper would complete the program.

This is not a job for inexperienced men. Neither is it a job for farmers to attempt at odd times. Occasionally we read articles on the subject in which it is stated that 4-H club boys can lay out terraces and farmers can build them with their farm equipment. They can—after a fashion—but this is not the type of work that will stand the test of time. Every dollar that is saved in such construction will kick back fivefold or more in maintenance costs, and the system will eventually have to be destroyed and rebuilt. Terraces must be properly laid out and correctly built for a number of reasons. We are dealing with water flowing in a channel, which knows nothing but to seek a lower level and destroy as it flows, if allowed to go on uncontrolled; and we are working with a farmer's land over which he must continue to operate farm equipment.

We read of successful terraces being built by farmers with only five days' training. I am not doubting the sincerity of the authors, but I do believe the projects have been judged prematurely. A project here in Shelby County, laid out and built in 1937, at a cost of $102.38, cost $305 in maintenance and revisions in 1944. Another one on the same farm built in 1938, at a cost of $273, cost $2.50 for maintenance in 1945. One was a successful terracing project, the other was not. The terraces we are building are costing from $15 to $20 per acre, but maintenance stands at the remarkably low cost of 2c per acre per year.

We can no more produce agricultural engineers and construction men in five days or five weeks than we can a doctor, lawyer, college professor, or any other professional man in the same length of time. We can exalt the profession by admitting that it is a profession and that it has to be learned the hard way.

I should like for the story of the progress we have made in this field of activity to be spread throughout other agricultural areas, and I am especially interested in other Kentucky counties starting similar projects after the war. Kentucky's farming industry can support approximately 200 small companies employing about 1,000 men. They can do an annual business of about 5 million dollars. Operating costs of approximately 4 million dollars would be added business for local communities. Necessary equipment to do satisfactory work would cost $3,820,000, and it would need to be replaced on an average of every five years.

Yes, there is a real job ahead for agricultural engineering and construction in this field of work.

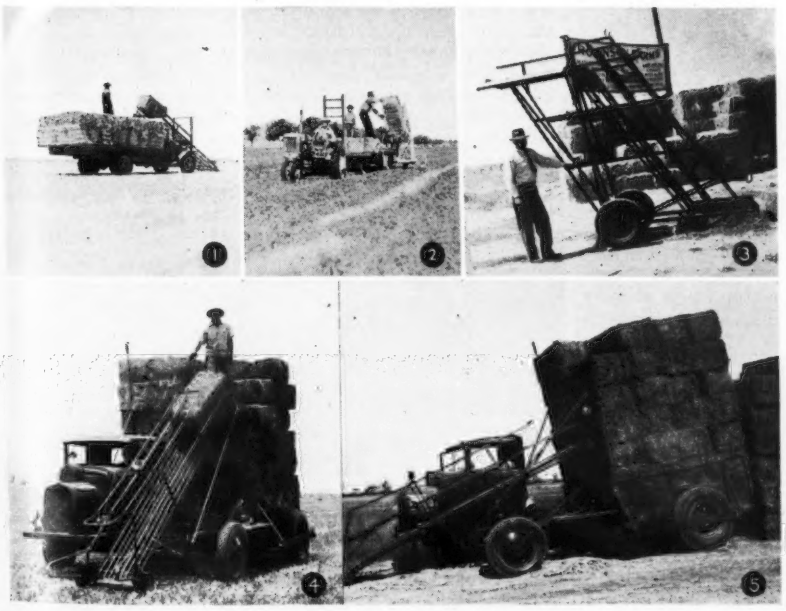
"Handling Baled Hay and Straw"

TO THE EDITOR:

I HAVE just looked over my copy of AGRICULTURAL ENGINEERING for May, and I got to wondering whether those who got together the article, entitled "Handling Baled Hay and Straw, Field to Storage," on page 191, had ever been out here where they really do it. This looks like a job that the agricultural engineering staff members at the University of California at Davis should have handled to really let your readers know what is going on in this field. Out here in the Imperial Valley they grow alfalfa for hay as big business; some of the things they do are shown in the accompanying pictures.

Your attention is specially called to a homemade bale loader developed by J. P. Fairbank, extension agricultural engineer at the University of California, which is a typical example of how the University hands ideas on to farmers of the state.

F. HAL HIGGINS



These pictures show types of bale loaders developed in California. (1) The cow-catcher type loader developed at Westmoreland. (2) The Adrian loader built at San Jose. (3) The Harris loader built at Stockton. (4) The Dinsmore bale loader-stacker. The first unit was built in 1944 on a farm near El Centro. (5) The Dinsmore loader-stacker dropping its load to form part of a stack.

Air Cleaners and Precleaners for Engine Protection

By N. R. Krause
MEMBER A.S.A.E.

ENGINE protection does not consist primarily of just running a tractor under a shed or throwing a cover over the engine in bad weather, but rather consists of providing the proper protective means whereby the air as required for proper carburetion is thoroughly cleansed of extraneous matter and abrasive dust particles. Satisfactory carburetion for all types of internal-combustion engines definitely involves a certain volume of air in combination with a proportionate amount of fuel, and if such air and fuel ratios change intermittently and such changes are beyond the control of the operator, the engine never really has a chance.

The modern farmer recognizes the sound engineering principles incorporated in the design of farm tractors and power units required to operate various types of farm machinery. It is also quite evident that the users of such machinery have not always treated some of the related accessory equipment with the proper respect, which in many cases results not only in poor engine performance but also greatly affects the working life of such a machine.

The initial purchase price of a power unit such as a tractor does not always hinge on the first cost, but rather on what such a unit would cost after being in operation for, say, a period of five years, and then considering what it might cost to keep it in working order. The highest priced tractor in the end might be far cheaper; however, whether it stays in good working order will often hinge on some secondary mechanism that might to the ordinary observer appear not to be of very much importance, but which might result in materially adding to the life of the machine.

Tractors and farm machinery units are very often operating in conditions that are beyond the control of the operator. For instance, in combining grain there are a good many conditions where light fluffy material is floating about in the air in all directions, and since a combine travels in all directions in the field, very often a tail wind will scatter chaff and debris over all of the power units used on such machines. This is a quite common condition found in a variety of farming operations, especially harvesting. These are conditions beyond the control of the operator and vary in locality as well as crop conditions. It must therefore be assumed that such machines in order to operate properly require the right kind of accessory equipment so that the power unit will operate at top-notch efficiency and at the same time eliminate the hazards of premature wear on vital parts which are expensive to replace.

Since only dust-free air is desired for carburetion purposes, it is quite obvious that the lack of proper filtering equipment would materially increase the upkeep as well as create conditions wherein the power unit would not function as intended. Air-cleaning or filtering elements as associated with farm power units in reality represents an important part of the breathing apparatus of the engine. Unless an engine can breathe in the proper amount of air as required for effective carburetion, its efficiency drops off to a point where it not only lacks power, but also uses an excessive amount of fuel with destructive results.

The development of air-filtering devices for internal-combustion engines as might be required for agricultural power units has been quite in step with the development of the present-day type of farm tractor. Present-day oil-bath air cleaners have proven to be quite an effective means of removing fine particles of abrasive dust from the air before it enters the carburetor or engine cylinder, and the capacity of such cleaners to remove dust will of course vary some with the design, size furnished for various size power units, as well as the conditions under which the units are required to operate. Since all such units usually require intermittent attention on the part of the operator for sediment removal as well as oil refills, it is also quite evident that the interest of the operator plays an important part in the final analysis as to whether such a device will function in the manner intended.

The design of most all current models of oil-bath air cleaners are more or less predicated on the idea of using some type of filtering element in combination with certain oil retaining structures, baffled and arranged in such manner so that the turbulence set up by the incoming air produces an oil mist through which all of the air must pass, the oil then separating from the air through the medium of the filtering biscuits, which in turn act to precipitate the oil and, while it gravitates downward, carries with it dust particles which finally settle in some form of sump.

A preferred design of oil-bath air cleaner no doubt should include means for convenient sediment removal as well as oil refill means.

Conventional oil-bath air cleaners, if not choked with chaff or other coarse material, function in quite a satisfactory manner so far as removing the finer particles of dust is concerned. However, for such filtering units to function as intended requires a presifting of the air so that coarse material such as leaves and chaff are definitely prevented from entering and fouling the oil-bath filtering elements or carburetor. In other words, it is just as important to protect the oil-bath air cleaner from clogging as it is to guard against the entrance of fine dust.

Oil-bath air cleaners are designed for the sole purpose of removing fine dust and will clog and be rendered more or less useless when chaff or coarse material enters. At its best the oil-bath air cleaner can do only one-half the job, the other half of sifting out the coarse material being primarily the function of the precleaner. Such a situation then creates conditions wherein the oil-bath air cleaner becomes the victim of the precleaner rather than being a unit which can take care of the complete filtering operation by itself.

Since all oil-bath filtering elements are more or less subject to clogging, it is quite evident that such elements too should be easily removable for cleaning or replacement purposes. Such composite units should also include effective baffling elements so that any engine backfires will not blow the oil out of the air cleaner. Any enclosed portions of an oil-bath air cleaner exposed to the air stream, and which is also exposed to the oil turbulence, might be allergic to building up some form of impediment to the air stream, and it is therefore quite evident that such elements should also be get-at-able for cleaning purposes.

Precleaner units in more or less common use consist of either some sort of a superimposed coarse screen cage ahead of the oil-bath air cleaner or a thin cloth sack tied over a supporting ribbed frame at the end of the air intake pipe and at some distance above the power unit.

The ordinary type of stationary wire screen cage when used as a precleaner is usually comprised of a coarse mesh screen surrounding the opening of the intake pipe and shielded with a cap. Such screens admit some sizes of coarse material to clog the carburetor and oil-bath air cleaner, or in themselves can clog on the outer screen surface completely with coarser debris. Such screens will remain fouled or clogged so long as the suction effort through the screen holds the material against the screen surface with the result that *such material will not fall away freely from the screen unless the engine comes to a complete stop.*

Any variation in suction effort caused by screen clogging produces a choke effect in the carburetor with resulting overrich fuel mixtures, causing overheating, a decided drop in power output, and also unnecessary wear of reciprocating elements due to upper-cylinder lubricating oil dilution.

In the buildup of cloth-sack precleaners, thin cloth is usually used for such purposes, and sacks made from it not only tear easily when cleaned, but also soon rot from exposure. Humidity conditions encountered in farm operations also adversely affect a cloth-sack screen, in that any moisture in the air during off periods of engine operation will cement the dust and dirt impaled in the cloth mesh in such a manner as to seal it off completely with destructive effects to the engine, without being noticed by the operator.

Very often a cloth sack precleaner is a sort of automatic choker valve for the engine. The flow of air through such a device in many cases is never constant and usually works just well enough to fool the operator. It never fools the *(Continued on page 245)*

This paper was prepared expressly for AGRICULTURAL ENGINEERING.
N. R. KRAUSE is research engineer, J. I. Case Co.

Mechanization of Sumac Leaf Harvesting and Processing

By E. L. Barger and J. M. Aikman

MEMBER A.S.A.E.

THE leaves of the sumac plant are a source of tannin used in the tanning and drying industry. While the leaves have been gathered for many years in this country from wild stands by hand and marketed, the growing of sumac as a cultivated crop has been done only on an experimental basis. The average yearly importation of sumac leaves over a nine-year period from 1925 to 1933, inclusive, was 6,210,000 lb. Sumac extract imports for the same period averaged 296,000 lbs[5*].

The record of the domestic production of sumac is incomplete but available data indicate the annual production since 1870 has been about 3,000 tons[4]. The estimated total of dried sumac leaves used annually from both sources, including tannin extract imports, would be 6,500 tons. Approximately 26,000 acres of native sumac would be required to produce this amount from domestic sources, based on an estimate of ¼ ton of dried leaf per acre. If established stands from root cuttings replaced native sumac stands, this acreage could be reduced to approximately 10,000 acres. Thus it can be seen that a comparatively small acreage would satisfy the present demand for sumac tannin.

Several tanning companies have indicated they could use much more sumac leaf than at present if they could get an improved quality of leaf. Four or five times the present amount of leaf could be used according to estimates furnished by two leading companies. Most of the importation of sumac has been from Sicily. While the Sicilian sumac is highly regarded by American industry and is used as a basis of comparison of quality, it is produced by hand methods that can not be considered practical or desirable in this country. The recent development of high tannin strains of sumac and improvement of harvesting and processing methods may result in increased production of American sumac leaf.

With the supply from Sicily cut off in the early stages of World War II, interest was stimulated in expanding domestic production. The Iowa Agricultural Experiment Station, in cooperation with the hillculture research section of the Soil Conservation Service and the Bureau of Agricultural and Industrial Chemistry, U. S. Department of Agriculture, had been developing and propagating high tannin strains of smooth sumac *(Rhus glabra)* since 1928[1, 2, 3]. This program was expanded in 1942 to include research in mechanization. It is the purpose of this paper to report progress made in two years in mechanical harvesting and processing sumac from wild stands in the hilly region of southern Iowa. The machines and processes developed are not offered as a final solution to the problem. Increased demand for the crop will be necessary before extensive development and refinement of equipment can be justified.

Plant Characteristics and Growth Habits. The main characteristics of the smooth sumac plant used in these experiments that affect the problem of mechanization are as follows: The height of plants varies from 2 to 7 ft. A variable cutting height of 1½ to 6 ft has been found desirable. The plants reproduce by horizontal underground roots which, under average conditions, grow 3 or 4 in below the surface of the soil. Under natural conditions, smooth sumac is a plant of forest borders which is well adapted by habit of growth to the invasion of the prairie. It requires more light than most other wood plants with which it grows. In the native state, the plants grow in clones or patches spreading radially from a central plant. Because of this method of reproduction, it readily forms pure stands. The tallest plants are usually in the center of the clone with the younger, shorter growth near the edges. Because of its poor competitive ability, it is unusual for tall and short plants to be intermixed in the stand. The height of the plants therefore increases toward the center and for the most part at a gradual rate. Variations in height of from 2 to 6 ft in a horizontal distance of 8 ft were measured but this variation was not common. The size of the native clones vary from a few plants to a pure stand of ¼ acre or more. Clones may be intergrown at the edges and a continuous patch of irregular shape may contain an acre or more.

Sumac has a compound leaf and the leaf consisting of leaflets and petiole-rachis (or leaf stem) is the only part of the plant desired for tannin. The tannin content of the whole leaf will range between 22 and 28 per cent in properly handled native sumac. The leaflets contain from 25 to 30 per cent and the leaf stems between 8 and 10 per cent tannin[1]. The leaves are more or less concentrated at the tops of the plants so that cutting 12 to 15 in below the top leaves removes the most desirable part of the plant. The stems at this elevation are woody in character and vary from ⅛ to ½ in in diameter. The plant is well adapted to rough, light soils and native stands are found on slopes varying from flat to 50 per cent or more. Tannin in the leaves is water soluble, and therefore rain or dew on the leaves following harvest is detrimental because of leaching of the tannin. A bright green color of the cured leaf is necessary to insure tannin of desirable light color. Drying or curing under cover has been found necessary to prevent loss from wetting and to assure a good quality of leaf. During dry weather, however, a good quality of sumac leaf may be obtained by drying in the sun without shelter. Fig. 1 shows a good growth of sumac plants. The female plants bear seed heads that are undesirable because of discoloration of the tannin caused by the seed. The male plants bear flowers that are not detrimental to

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*Superscript numbers refer to the literature cited at end of paper.

Fig. 1 (Left) A typical growth of native smooth sumac *(Rhus glabra)*. Seed heads indicate a female plant. The seed are undesirable in the processed leaf • Fig. 2 (Right) Experimental sumac harvester operating in an unusually clean stand of native sumac.

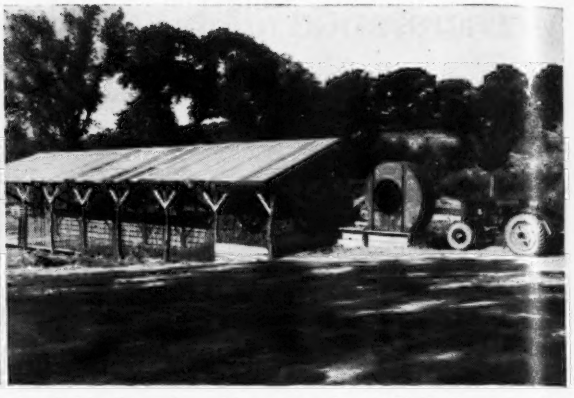

Fig 3 (Left) Picking up wilted or partially dried leaves from windrows deposited by the mechanical harvester • Fig. 4 (Right) Sumac leaf drying shed using forced circulation of unheated air

the quality of the leaf unless it is harvested too early in the season (before the last week in June for southern Iowa).

Mechanical Harvesting. The experimental harvester used in the mechanical harvesting experiments reported in this paper is illustrated in Fig. 2. It is mounted on a track type tractor to give necessary traction and stability on steep slopes and rough terrain. The header attachment is from a McCormick-Deering No. 42 combine. Width of cut is 42 in. Height of cut is controlled by a hydraulic lift to the cutter bar. Height of cut is adjustable from 1½ to 5½ ft. The height of cut must be varied more or less continuously to cut only the top leafy stems from the plants. The header discharges into a box mounted across the rear of the header and the tractor. The bottom of the box is equipped with a chain and cross-bar apron. The apron is power driven and controlled by a clutch at the operator's left. As the box fills, the apron drive is engaged momentarily and the pile is moved to the left, making room for more leaves. After the entire box is filled, the machine is driven out of the clone to ground clear of stubs and brush, the apron clutch is engaged, and the leaves are run out into a windrow to start drying. The harvester is then driven back into the clone for another load, or the machine moves on to the next clone to be harvested. Since the native stands may be scattered, considerable time is lost in travel between clones or patches. Under favorable conditions about 3 tons of green leaf can be harvested in an 8-hr day. This is about equal to the quantity of leaf harvested by hand by 10 men.

A much lighter machine could be built for harvesting an even stand of cultivated sumac. If grown in strips on the contour on slopes as a soil-conserving crop, it would be possible to operate on the contour and eliminate many of the problems of harvesting the scattered native clones. The leaves were allowed to wilt in the windrows and then were picked up by truck. This operation is illustrated in Fig. 3. Wilting in the windrow reduced the moisture content of the green leafy material from about 62 per cent to about 55 per cent.

Drying the Leaves. When drying small quantities of leaves it has been common practice to spread them on barn or crib floors. A daily turning is required. Artificial drying is required if the leaves are to be handled in large volumes. The quality of the leaf is influenced greatly by the drying or curing. The large drying shed shown in Fig. 4 has been in use for two seasons. It makes use of unheated air. The shed is 20 ft wide by 64 ft long and may be filled to an 8-ft depth. Air is supplied with a large mine-shaft fan supplying normally 20,000 cfm through a tapered tunnel the length of the shed. Air vents are provided in the sides and top of the tunnel.

Leaves were brought to the drier with an average moisture content of 55 per cent. They were spread uniformly over the air duct and the fan started. The depth of leaves was built up until the shed was full. Fig. 5 shows the average drying curves of two batches of leaves dried in the large drying shed with unheated air. Outside air temperature varied from 50 to 80 F (degrees Fahrenheit). Relative humidity was 100 per cent for an average of 10 hr each night, dropping to an average low of 60 per cent during the day. During these periods, the blower was operated an average of 6 hr per day.

Fig. 6 shows a batch drier, employing heated air, used in tests to measure the effects of methods of drying on leaf quality. In this drier a common house furnace was used with a blower, forcing heated air through the leaves. The 8x12x8-ft high building satisfactorily dried 1600 lb of leaves (green weight) at a time, and charging, drying, and emptying required two days. The air was heated 10 to 12 F above outside temperatures. Fig. 7 illustrates skivers or small pieces of split sheep skin tanned with the leaves processed by different methods to test the quality of tannin. The color of the leather indicates quality. The lighter the color of sumac leaf tanned leather the higher the quality of the leaf. It can be noted in the figure that the heated-air dried leaf sample No. 1 is superior in quality to that produced by other methods. The leaf from the large drier using unheated air, sample No. 2, was next in quality. The drying costs favored the unheated-air drier. Samples Nos. 3 and 4 represent best quality and poorest quality farmer cured leaves, respectively. Tannin analysis of the leaves dried by the different methods showed that the more rapidly the leaf was dried, the higher the tannin content, provided the leaf was not heated in excess of 140 F°. Another indication of the quality of the leaf is its resemblance in color and composition to the original green leaf°.

Stripping and Cleaning. Leaves harvested by machine, and also those harvested by hand, if the tops of the plants are broken out, contain woody stems and seed heads that must be removed. Flailing the leaves by hand will break the dried leaves from the stems, but the process is tedious and the leaf is broken too finely for baling. Passing the dried leaf material between a rotating cylinder and stationary concave was tried. A combine with rubber-faced cylinder bars and rubber shelling plate did not give satisfactory

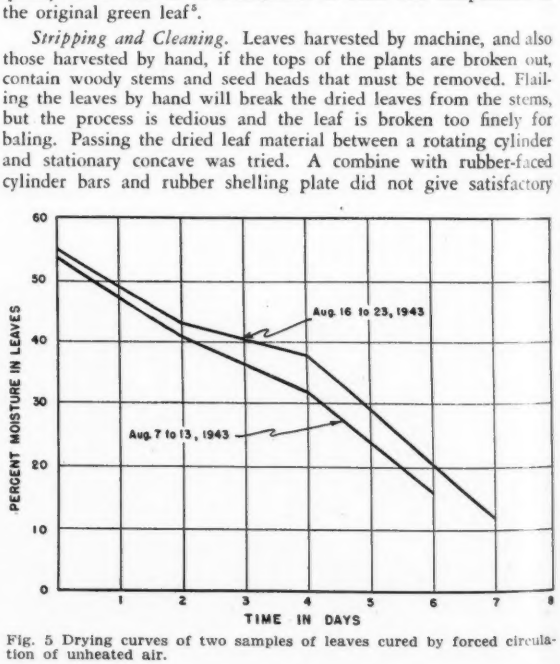

Fig. 5 Drying curves of two samples of leaves cured by forced circulation of unheated air.

Fig. 6 A batch drier using heated air used in experiments to compare the quality of leaf dried by different methods.

Fig. 8 Using a modified grain thresher to strip and separate the woody residue from the leaf. The residue is approximately 25 per cent by weight.

results. Satisfactory results were obtained by passing the material through a modified grain thresher with the conventional spike-tooth cylinder. A peripherial speed of between 2300 and 2900 fpm was found satisfactory with the leaves at an average moisture content of 14 per cent. Best performance was obtained by removing all teeth from the concaves. All spaces for concaves were filled with blanks and the cylinder speed adjusted to give the desired stripping effect to remove the leaves from the stems, but breaking the leaves up as little as possible.

Separation could not be made on the racks and screens of the threshing machine. The woody stems and leaves moved back over the straw rack together. The finer broken leaf particles fell through the rack and worked back over the chaffer sieve. Seeds loosened from seed heads were removed through the grain and tailings conveyors. Separation of leaf and stem was obtained at the rear of the machine by gravity in an air blast created by the cleaning fan. The fan was operated over normal speed. This operation is shown in Fig. 8. The design and construction of a suitable leaf stripper would be reasonably simple, but will probably not be undertaken until such time as the demand for sumac leaf becomes large enough to justify the development work.

Three tests to determine the yield of clean leaf from dried machine-harvested leaf using the modified thresher as a stripper gave 77.5, 72.0 and 73.8 per cent, averaging 74.3 per cent. The corresponding percentages of waste or woody residue were 22.5, 28.0, and 26.5, averaging 25.7 per cent. The latter figures may be considered the shrinkage resulting from the stripping and cleaning operation. Samples of the cleaned leaf and woody residue were separated into their component parts to measure the effectiveness of the stripping and cleaning operation. Table 1 gives average results obtained in this test.

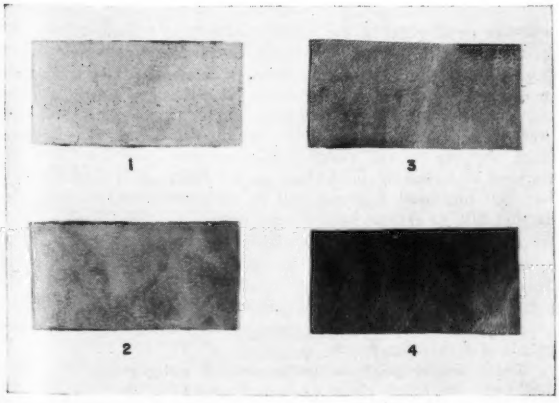

Fig. 7 Skivers used in testing the tannin quality of sumac leaves. No. 1 was tanned with leaf dried artificially with heated air. No. 2 was tanned with leaf from the drying shed using unheated air. No. 3 was tanned with best quality farmer-cured leaf, and No. 4 was obtained with farmer-cured leaf of poorest quality

TABLE 1. ANALYSIS OF CLEANED LEAF AND WOODY RESIDUE STRIPPED AND CLEANED WITH MODIFIED GRAIN THRESHER

	Cleaned leaf	Woody residue
Leaflets, %	79.1	10.2
Petiole-rachis, %	17.3	13.2
Seeds, %	0.3	4.7
Wood, %	3.3	71.9

Baling the Leaf. The conventional hay press can be used to bale the leaf. The foot piece was removed from the feeder head to reduce the tendency of fine material to be forced into the bottom of the baling chamber. Three wires are desirable, and end caps should be used on the bales. Corrugated board caps were found desirable, although any tough paper was found to be usable. The leaf cuts readily under the pressure of the wire and shattering is apt to be excessive unless caps are used. Both plain and galvanized bale ties were used. Iron rust reacts with the tannin to form ink which is very undesirable in tanning material. The use of galvanized baled ties seems to be a good precaution, but it has not been established as a "must".

Shipping and handling the baled leaf was done in much the same way as hay is handled. Additional precautions to keep the leaf clean and dry must be taken.

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Engine Protection

(Continued from page 242)

engine, but instead creates expensive repair bills by promoting dilution of cylinder lubricating oil, reducing the power output of the engine, creating unnecessary variations in speed because of lack of power, as well as promoting overheating.

Many operators continue to run their engines even with torn or defective sacks with the result that the oil-bath air filter soon clogs because of coarse material entering. Such a condition then completely demoralizes the function of the oil-bath air cleaner. Any lack of attention on the part of the operator when servicing precleaners hardly gives the engine or the air cleaner a chance, and in many cases sets up a sort of interference that takes away from the theoretical efficiency of both.

The function of an oil-bath air cleaner is to remove dust from the air. In this respect such units function in quite a satisfactory manner, and unless a satisfactory precleaner is provided so as to overcome the difficulties already referred to, the engine really never has a chance.

Water Management for Food Production and Security

By C. C. Ricker
MEMBER A.S.A.E.

SECURITY is the prime desire of every normal person, security for himself, his community, his nation and the world. To the individual this means life, liberty and the pursuit of happiness. It involves social and economic security and security from want and fear and from the catastrophes that produce them, such as floods, droughts, famines, pestilences and wars.

One of the first requisites of security is an adequate and never failing supply of food. In our present emergency, food has rightly been classified as a basic war material, and its production as a most important war activity. The abundant production of food therefore is an urgent necessity for success in war as it will be for security in peace.

Water, the major content of most foods is probably the most important factor in the production of food; in fact it is the one indispensable factor. It is sometimes called the mainspring of life because all life is dependent upon a constant and never failing supply of water. As blood is the life of the body, water is the life of the earth including both plant and animal life. May we emphasize this by observing that man may live several days without food but would live only a few hours without water. However, while water provides us with everything we have to eat or drink or wear, it is also a powerful compound for destruction, and ways and means must be found to stop or retard the damage it does. Water management, therefore, is a most important factor in using and controlling water for food production now and for security now and in the future.

Engineers with their knowledge of and training in the use and control or management of the materials and forces of nature for the benefit of society, should take the initiative in dealing with the problems involved in the practical application of water-management techniques for the benefit of agricultural production.

To deal adequately with the problem we must be thoroughly familiar with the nature and extent of the materials and forces creating the problem. The earth's surface is about three-fourths water and one-fourth land, and if the earth were leveled off, water would completely cover it to a depth of nearly two miles. Water moves through what is known as the hydrologic cycle. First it evaporates, becomes water vapor, expands and ascends, where upon cooling it forms clouds and upon further condensing is precipitated back to the earth. The process is an endless, ceaseless cycle.

In the natural operation of this cycle there is usually either a surplus or a deficiency of water on the land. It is this surplus or deficiency which creates the problem of water management. In arid regions, the lack of water must be supplied from storage reservoirs previously planned and filled. In the humid regions, the surplus must be controlled or managed to prevent damage, and used to benefit society. All activities in a water-management program can be mutually or reciprocally beneficial. Water stored for irrigation of arid regions is prevented from creating floods and causing erosion. Surplus runoff water controlled to prevent erosion and floods can be used for industry, power development, improvement of navigation, and recreation.

Let us consider some of the destructive actions of water that need to be controlled or managed for the good of all. The surface of the earth was once destroyed by water in a flood of cataclysmic proportions. Since that event water, the greatest solvent known, has been continuously at work building up and tearing down the products of nature. It is true that constant dripping water wears away the hardest stone. Barring the actions of other forces, water would eventually level off the earth's entire surface. Water is the master sculptor, being principally responsible for the form of the earth's surface with its many beautiful variations.

An example of its leveling powers is Manhattan Island, on which New York City now stands, which once was a mountain, but which was washed away by water and time. The greatest example of the cutting and dissolving powers of water is the Grand Canyon of Arizona, where the Colorado River has cut through thousands of feet of marble, granite and other hard rocks to a total depth of more than a mile. This artistic sculptor is responsible for the fantastic Garden of the Gods in Colorado, the unique Palisades of the Hudson River, the ecstatic grandeur of the Canyon of the Yellowstone, the underground caverns and formation of the Mammoth Cave of Kentucky, and many other beautiful formations in our mountains, canyons and valleys. An awe-inspiring example of the cutting power of water is Niagara Falls which are now seven miles from where they started, the water having cut, dissolved and worn away the rocks through the years.

These are examples of geologic erosion, although spectacular in appearance, do not represent the destruction of natural resources that is happening through the formation of their types in miniature observable as gullies in many cultivated fields. These are man-made, or induced by the acts of man. Their by-products are wasted soil and fertility, clogged drainage channels, depleted reservoir capacities, and destructive floods.

The basic cause of all these is the uncontrolled runoff of surplus water. If there was no surplus water, there would be no water erosion and no floods. Of course a deficiency of water is the basic cause of wind erosion. It is evident, therefore, that soil erosion is caused or permitted by either a surplus or a deficiency of water. Logically then the fundamental solution of the problem of soil erosion is control or management of the surplus water.

Naturally the problem is more acute and its solution more complex in the humid areas where safe interception and disposal of surplus runoff attains major importance. Problems of water disposal and their treatment form the basis of the engineering aspects of soil and water conservation. The problems and their treatment vary with local needs.

On sloping lands, maximum infiltration is of primary importance. The fundamental objective of treatments on such areas is to reduce the volume and the velocity of the surface runoff. Infiltration may be increased by soil improvement through cultural and agronomic practices such as better rotations to add organic matter and improve soil structure and make it more absorptive, and contour cultivation, supplemented by terraces and diversions where needed, to retard runoff. It is conceivable that mechanical means may be used under conditions existing in some localities to break up the subsoil and increase the porosity to depths sufficient to absorb more water, and thereby considerably reduce the surplus. This would have the further advantage of conserving more water in a place where it would be available for growing crops, when needed, enabling them much better to resist drought conditions. Experience has shown that production is usually increased 10 to 20 per cent by the use of such a simple practice as contour cultivation.

The reduction and retardation of surface runoff with the accompanying reduction of erosion will diminish the problem of drainage or disposal of the surplus water that collects on the low lands. Drainage facilities previously established which now appear inadequate could, in many instances, be rehabilitated by merely removing the vegetation and the worst silt blocks and debris or other obstruction from clogged channels. An adequate system of field drains, which could be made with the regular farmer-owned equipment, utilizing the full possibilities of existing outlets would work wonders in increasing production on wet lands. It is a well-known fact that improved drainage will in many instances increase production fifty to several hundred per cent.

A general application of the above practices would, in addition to increasing food production, result in a more uniform and continuous disposal of the surplus runoff, facilitating its use for all purposes, reducing expense of purification for domestic use, encouraging power development and industrial uses, improving navigation, and reducing floods.

These simple practices can be carried out now without conflict with any other phase of war production. On the contrary, they would make a major contribution to the speedy and successful conclusion of the conflict. A complete water-management program involves the solution of many more problems with many other activities which of necessity must *(Continued on page 248)*

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A Comparison of Erosion Losses After Turning Under Legumes and Non-Legumes

By Russell Woodburn
MEMBER A.S.A.E.

IT HAS been well established by the work of many investigators that a cover on the surface reduces erosion losses, particularly soil loss. The cover may consist of living plants or a mulch of plant residue and be equally effective, depending upon the amount and type of material involved. There is little question that well-established, vigorous winter legumes, such as vetch, reduce soil loss materially below that expected from bare surfaces. There is a question, however, as to the amount of soil saving by the legume after it is plowed under. The results reported in this paper present a comparison of erosion losses from legume plots with losses from non-legume plots during the period immediately after plowing the legumes under and during the growing season thereafter. During the month of April, 1944, an unusual opportunity was presented to observe the effect on soil loss of a turned-under winter legume. Plots freshly spaded and settled were similar in surface appearance whether legumes or non-legumes had been turned. Five rains which then occurred caused a wide degree of difference, however, in soil loss for the spaded land following vetch and following no vetch.

The data reported were secured from ten 1/40-acre plots on slopes from 2.5 to 12.5 per cent on Houston clay soil, and located on the main farm of the Mississippi Agricultural Experiment Station. The plots are in a 3-year rotation of corn, cotton and cotton. Vetch is used as the winter cover each year on one-half of the plots. The remaining plots do not have any planted winter cover. The latter plots are not entirely bare through the winter, however, as was the original intention of the experiment, on account of debris from the previous crop of corn or cotton and on account of annual weeds, such as henbit (lamium amplexicaule), which volunteer. There was about 1200 lb per acre green weight of the weeds and about 9000 lb per acre green weight of vetch at the time of spading the plots.

There was no bedding or ridging of the land in 1943 (first-year cotton) or 1944 (second-year cotton). The cotton was planted on the contour and cultivation was very light. An attempt was made to avoid building a ridge along the row. Definite contour ridging, while saving soil, introduces a possibility of a variable from plot to plot.

Loss from March and April Rains. In Table 1 soil and water losses for all plots for part of 1944 are shown. There was no soil loss and only negligible runoff on either set of plots from January 1 to March 26. There was heavy rainfall during this period, particularly in February and the early part of March, as indicated by the soil loss of 30 tons per acre from a bare plot nearby on a 9 per cent slope.

As long as the weed cover was undisturbed during January and February, it gave a good degree of protection to the plots—in fact, almost equal to the undisturbed vetch.

When the rains of March 26 to 29 came, the spading had all been completed except for strips of varying widths at the lower end. There was a strip crop effect by the unspaded cover, however, so losses were light. The 5.51 in of rain for this 4-day period caused 20 tons per acre soil loss on the bare plot.

The spading was entirely finished around April 5 so that by April 9, when the next rain fell, there was a bare surface on all plots, following both vetch and weeds. Although this rain caused nearly 2 tons per acre soil loss from the continuously bare plots, there was no appreciable loss from the freshly spaded plots. This rain settled the most recently spaded portion of all plots, and after the rain it would have been difficult to determine by surface inspection which of the plots had vetch spaded under and which had no vetch. The surface appeared fairly well sealed over on all plots. The surface was sealed to a much greater extent than usual during the long period of rain and cool weather. This soil ordinarily has a tendency to aggregate by drying and wetting and rarely seals to any appreciable extent.

Between April 11 and April 26 (Table 1) five rains of moderate to high intensity were experienced. During this period the soil loss from the vetch plots was less than from the non-vetch plots for each rain and for all slopes. Soil losses during this period were very severe, and upon the higher slope plots about the same as from the continuously bare plot. The 1.83 in rain of April 23 actually resulted in about one-third more soil loss on the 12.5 per cent slope plot following weeds, than from the continuously bare 9 per cent slope plot.

It may be seen (Table 1) that during the April period there was a much greater effect of the vetch on soil loss than on runoff. It would normally be expected that a looser soil condition would obtain where a heavy stand of vetch was spaded than for very sparse weeds. Greater permeability would be expected for the vetch areas. This is indicated, to some extent, by the runoff percentages for the two cases. The reduction in runoff by the vetch is not sufficient to explain the reduction in soil loss which took place on the vetch plots. It would, therefore, appear that there was a difference between the two conditions at the actual surface, even though no difference was apparent to the eye.

TABLE 1. EROSION LOSSES AND COTTON YIELD FOLLOWING VETCH AND WEEDS, 1944

Winter cover	Rainfall, in	2.5% slope		5.0% slope		7.5% slope		10.0% slope		12.5% slope		9% slope
		Vetch	*Weeds	Vetch	Weeds	Vetch	Weeds	Vetch	Weeds	Vetch	Weeds	Bare
		Soil loss, (tons per acre)										
April 9	0.55	0	0	0	0	0	0	0	0	0	0	1.9
" 11	1.33	†T	.1	.1	.5	.1	2.3	2.9	5.3	4.6	6.2	8.6
" 18	1.27	T	T	.3	1.1	.7	3.0	3.3	5.4	4.3	5.4	5.4
" 20	0.75	T	T	.1	.3	.3	1.1	1.0	1.6	1.3	2.2	1.8
" 23	1.83	.4	.7	2.4	3.8	4.4	8.0	8.2	10.6	9.8	13.3	10.1
" 26	0.42	.1	.2	.3	.8	.7	1.4	1.5	2.5	2.1	3.1	3.5
May total	3.33	T	.2	.1	.6	.5	1.6	1.3	2.3	1.9	3.0	6.4
‡July total	5.48	0	0	0	0	0	0	.3	0.9	3.2	4.3	24.5
Aug. total	3.54	0	0	0	0	0	0	0	T	T	0.3	19.8
		Runoff (percentage of rainfall)										
April 9	0.55	1	1	1	1	1	1	3	3	3	3	34
" 11	1.33	4	17	11	26	11	33	31	42	38	35	80
" 18	1.27	11	37	22	41	27	36	28	37	29	28	53
" 20	0.75	7	20	10	11	15	24	17	24	21	20	49
" 23	1.83	29	47	35	47	45	48	39	41	39	40	63
" 26	0.42	31	47	36	70	46	54	51	56	61	66	76
May total	3.33	3	10	9	9	8	11	8	10	9	11	55
July total	5.48	0	0	0	0	0	1	5	7	12	13	45
Aug. total	3.54	0	0	0	0	0	0	0	T	T	4	46
		Yields of Seed Cotton (pounds per acre)										
		2750	2550	2620	2550	2620	2420	2430	2510	2730	2690	

*Henbit (Lamium emplexicaule)
†T, trace
‡No June losses

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Mechanical analyses and aggregate analyses of the surface layer on all plots did not show any particular difference. It was, therefore, concluded that there must be somewhat more organic trash at or near the surface where the heavy vetch had been turned than following the light weed growth. The soil saving following vetch would, therefore, be a low degree manifestation of mulch action. No clear cut results were obtained by attempts to sample and analyze the actual trash present on the apparently clean surfaces. More debris would have been expected, however, following the vetch than following the scant weed growth. When heavy green vetch is spaded or plowed under, complete coverage of all trash is almost impossible, particularly of the fibrous roots exposed by the turning over process.

Borst and Woodburn[1] report significantly less soil loss from corn following grass and clover than from corn following a bare condition. They surmise that factors involved were binding effect of undecomposed grass roots, greater vigor of roots and more canopy interception for the corn following meadow and more erosion-resistant soil structure following the meadow.

More study is necessary before final conclusions can be drawn as to the exact mechanics of the soil-saving action of the vetch. A number of years may be required before the 1944 combination of very good vetch and high intensity rains immediately after plowing occurs again.

It is believed that the favorable results reported for winter legumes would be typical for any year when a good stand is obtained. Winter weed cover would rarely be any heavier than reported for 1944 and in any event would normally be much lighter than any ordinary stand of vetch. Soil saving by a very poor stand of vetch could not be expected to equal the values reported for April 1944.

Loss from Summer Rains. After the April rains, the next storm period occurred on May 4 and 5 when 1.70 in of rain fell. The same effect as noted through April was shown for this rain.

During the growing season of the cotton a number of rains caused moderate soil loss on the bare plot but none on the plots protected by a thick stand of vigorous cotton plants.

A very high intensity rain of 2.05 in on July 27 and 28 caused losses of 2.96 tons and 3.88 tons per acre on the 12.5 per cent cotton plots following vetch and no vetch, respectively. The bare plot without cotton plant protection lost 14 tons per acre.

As noted in Table 1, very high yields of cotton were obtained from all the plots with but little yield influences shown for the vetch. These yield data and field observation indicated that there was little, if any, difference in the size of cotton plants between vetch and no vetch conditions. It would therefore appear that any difference between the erosion losses for vetch and non-vetch plots during the summer could not be accounted for by differences in canopy protection by the cotton plants.

Although erosion losses were light during the growing season, there appeared to be some residual effect of the vetch.

SUMMARY AND CONCLUSIONS

1 Although the surface looked about the same after spading vetch and a light weed growth, more soil loss occurred for the April rains on plots following weeds than on plots following vetch. This trend was very pronounced as it occurred on five different slopes and for five distinct rains.

2 Although the canopy protection by the cotton greatly reduced erosion losses and therefore, to a great extent, masked any differences between vetch and no vetch plots, the soil-saving effect of the vetch appeared to continue to some extent during the summer.

3 Vetch after spading under still had a reducing effect on runoff, except on the steepest plots. Saving in soil was in greater proportion than saving in water. Soil was saved even on steepest slope where there was no runoff difference. It therefore appears that the reduction in soil loss by the vetch was partially at least a surface phenomenon.

4 The reasons for soil saving by the vetch are not entirely clear but it is thought that minute amounts of debris inadvertently left on the surface by the spading process result in a low degree mulch action.

[1] Borst, H. L. and Woodburn, Russell, "Progress Report of the Northwest Appalachian Soil and Water Conservation Experiment Station, Zanesville, Ohio, 1933-37" SCS-ESR-8, January 1939.

Water Management for Food Production and Security

(Continued from page 246)

be postponed for the duration of the war. However, it appears timely to consider some of the possibilities of postwar activities along this line.

In addition to being the most important factor in agricultural production, water is probably our most important natural resource for urban production. Water is used either directly or indirectly in practically every manufacturing process of any importance. Generally clear pure water is desired, and frequently the temperature is important. For domestic use, it is imperative that the water be clear, pure and free of undesirable tastes and odors.

In the industrial development of our country we have not had the foresight to protect this great natural resource. We have permitted our valuable surplus supplies of water to be dissipated in destructive floods and allowed our beautiful streams to be polluted with sewage and industrial wastes. In the face of this predicament we still allow pure water to flow into stream beds and become polluted and then go to the unnecessary expense of pumping it out against gravity and treating it expensively to make it even disagreeably useful. Our treatment of our water resources is as wasteful as if we would set fire to our coal mines and allow the heat generated to be dissipated instead of harnessing it to some useful work, and moreover to allow the obnoxious gases to befoul the air we breathe. Fortunately, if we change our attitude, we can reclaim this great natural resource for future use, because it is constantly being renewed.

IMPOUND WATER TO REDUCE DESTRUCTION

With proper water management, we could impound some of it, before it becomes polluted, in upstream reservoirs or ground storage whence it could flow by gravity to points needed, and at the same time reduce its destructiveness. In a well-organized and coordinated water-management program, the solution of each problem would be reciprocally beneficial to the solution of every other problem involved. The benefits therefore that would accrue to individuals and communities that can not be calculated into a definite plan of self-liquidation would no doubt in time become much more valuable as a tax-yielding asset than the original cost of the program.

Like the man who slew the proverbial wolf clawing at his door and used the carcass for meat and the hide for raiment, we could with proper management of our water resources convert them to beneficial uses and in the same act eliminate or at least mitigate their destructiveness. Reservoirs and other means for retardation, retention and storage of surplus water would not only reduce erosion and destructive floods, but would conserve supplies for water power, irrigation, domestic and industrial uses, and recreation.

Of course every phase of the program should be thoroughly coordinated with every other phase in order that the beneficial results might be properly distributed. Trying to protect a few cities by flood protection levees, while of immense benefit locally, appears to be a rather superficial treatment of the whole problem. Probably a comparable amount of expenditure on control works in the upstream portions of the watershed would afford equal protection to the whole valley, in addition to the many other benefits that would accrue from the storage of the surplus water.

The techniques of water management are well understood by engineers, and men, means and material will be available after the war to apply them. If all the nations of the earth could be interested in making this a universal program for the betterment of their people and work toward the objective with the energy they have expended for war, peace would reign for some time at least, and everybody would be happy. Satisfied people don't fight except in self-defense.

A comprehensive program of water management for the benefit of all purposes would be an important step toward the God-given order to "be fruitful, and multiply, and replenish the earth, and subdue it" (to human uses). The completion of the program would go far toward the fulfillment of the prophecy of Isaiah when "the desert shall rejoice and blossom as the rose," "and the parched ground shall become a pool, and the thirsty land springs of water."

Prerequisites of a Sweep Stubble-Mulch Tillage Implement for the Southern High Plains

By F. G. Ackerman and J. C. Ebersole

FOR A tillage implement to be suited to practical farm conditions and acceptable to the farmer, it must be adaptable to a rather wide range of soil and moisture conditions. It must perform the function for which it is designed, without difficulty and at a reasonable cost.

Interest in residue management or stubble mulching has led to a rather extensive development of implements designed to leave plant residue on the surface. Two general designs of blades have resulted; one a straight blade and the other, various styles of V-shaped sweeps. Because the sweeps give more successful operation during supplemental tillage and because under certain conditions they can be used on the ordinary tractor-attached toolbar, this type of implement is favored for general use in the Southern High Plains.

In the wheat-growing area of the Southern High Plains, the trend in this development has been toward implements which are suited to both initial and supplemental tillage operations. The reasons for this trend are obvious. Stubble-mulching attachments, designed for use on already existing equipment, have been only partially satisfactory and especially designed implements now available are more limited in their range of adaptation than the one-way disk or mold-board plows. Consequently, they are not freely accepted and used by farmers. The full value of crop residue as a means of protecting the soil cannot be realized if stubble-mulching implements are not used for all operations in seedbed preparation. However, there will be occassional years of heavy residue when strict stubble mulching will not be needed in order to provide ample protection for the soil. During such years, partial covering of the residue might prove the most desirable way of handling it. When strict stubble mulching is desirable, which will be most years, it would be a saving to the farmer to have a single implement with which he could satisfactorily perform all tillage operations.

While the full value of efficient use of plant residues for soil and water conservation may not have been recognized until recently, many attempts were made to use sweeps in various ways. With the exception of the use of small sweeps on relatively clean ground and in row-crop cultivation, these attempts have met with little practical success. Recent experience indicates that past failures with large sweeps were due largely to lack of proper design of the sweeps and the implement to which they were attached.

The function and value of crop residue left on the surface of cultivated fields have been well demonstrated recently by Duley[2]*, and Duley and Russel, et al[3, 4]. The work of these men has been a stimulus in the recent development of implements designed to till land without covering plant residue. Noble[6], Duley and Russel[5], Chase[1], and Nutt, McAdams and Peel et al[7], have pioneered in the development of farm implements for residue management. The work of these men has clearly shown the varied application of this system of culture in the different agricultural regions of the country. They have also pointed out the limitations of implements and attachments now in use. The rod weeder, even with subsurface tillage attachments, is suitable for initial tillage only under favorable soil and moisture conditions. It will also clog when operated in heavy residue. V-shaped sweeps of various sizes and design, when attached to shanks of lister frames and similar implements, have given satisfactory results only under the most favorable conditions. In fact, farmers attempting to use them in this area have often had to set them aside and till their land with the one-way plow. The straight blade, such as the one described by Noble[6], has generally been suitable for the initial tillage operation but when operated at a shallow depth during successive tillage, much trouble results from the fouling of the blade. It is recognized that there are conditions under which each of these implements or attachments operate satisfactorily and their value should not be underestimated. On the other hand, when it becomes necessary, during seedbed preparation, to use an implement which turns the soil, less residue is left on the surface as protection. Farmers of the Southern High Plains realize they need this protection and what they are looking for is a stubble-mulching implement which can be used with the same ease and under the same conditions as the one-way disk plow. The one-way is well liked by farmers and if properly operated, can be made to leave some residue on the surface the first or even the second time over if the residue is heavy to start with. When residue is not excessive or when land is to be summer fallowed, a strictly stubble-mulching implement should be used so that a maximum of residue will be left on the surface.

In carrying on tests at the Amarillo Conservation Experiment Station and on field trials in the Panhandle of Texas and Oklahoma, it was soon realized that a stubble-mulching implement for wheat farmers in this area would necessarily be one especially designed for that purpose. It was seen that it must compare favorably with the one-way in adaptation and ease of operation. With these conditions in mind, many types and arrangements of sweeps and the straight blade have been tried. As difficulties in operation were encountered, changes were made in the implement until the faulty condition was improved. A brief summary of the results of these many alterations as reflected in fundamental requirements for a sweep stubble-mulch implement is given in the following paragraphs.

The sweeps must be sturdy and of good steel construction in order to withstand the strain of tilling at reasonable depths in dry, heavy soil. The initial tillage in preparation of the seedbed usually offers the greatest strain on the implement and it must be built to withstand all such tillage. Because the sweeps operate more satisfactorily during a second or successive operation when the initial tillage is performed with sweeps, it is best, when possible and practical, to use sweeps for the first operation. Medium to heavy residue, when mixed deeply into the soil during the first operation by an implement such as the one-way, tends to cause "dragging" when the sweeps are used for the second operation, particularly if no packing rain occurs between the operations.

The angle included by the wings of the sweep should not exceed 60 to 65 deg. It is recognized that sweeps of greater angle have given satisfactory results under some conditions but there are many limitations in the wide-angle sweep. With a 60 to 65-deg included angle, the wings of the sweep have sufficient backslope to permit trash that may become lapped across them to slide backward and clear the sweep. In loose or wet soil, sweeps cannot be kept sharp enough to cut undecayed residue. Recognizing this angle as essential in the sweep, the maximum width is then limited by the length of wing which can be constructed in a practical way to withstand the strain of initial tillage. With the present information, this width appears to be about 30 in. This width sweep permits sufficient overlap (4 in) for good weed kill and, at the same time, places the sweep shanks sufficiently wide apart to allow heavy residue and weeds to pass between them. Chase[1] found this angle of sweep most satisfactory but recommends less overlap of sweeps as a factor in scouring of blades. We have found that when tilling shallow, as recommended for last operations, some weeds, such as the Russian thistle, will escape the blades if sweeps are not overlapped about 4 in.

The pitch or angle of the blade to the horizontal should be steep enough to pulverize the soil moderately but should not be so steep as to cause ridging of the soil or excess covering of residue when drawn at moderate to fast tractor speed. With a sweep having the recommended angle and a uniform blade 4 in wide, the back margin of the blade should be raised approximately 1⅜ in.

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*Superscript numbers refer to the bibliography at end of paper.

This pitch of blade gives fair pulverization but will not cause ridging and will allow most of the residue to remain on the surface. If more pulverization is desired, it can be obtained by attaching pulverizing rods to the back margin of the sweep. These rods can be bent up or down to vary the degree of pulverization. If the sweep blade tapers from 4-in width at the shank to 2-in width at the heel, somewhat more pitch can be allowed without increasing the tendency of the sweeps to ridge the soil.

When using 30-in sweeps, the front row of sweeps should be at least 18 in ahead of the back row. When a closer spacing is used, insufficient space remains between the heel of the forward sweeps and the wing of the rear sweeps for the passage of debris that becomes lapped over the edge of the sweeps and which must pass over the heel of the front sweeps before they can operate freely. Closer spacing has an advantage when residue is light but invites trouble in heavy residue. This item is important to success and is one which is often overlooked.

The sweep carrier or implement itself must be rigid and sturdy enough to withstand the strain of initial tillage in heavy, dry soil. It must be heavy in itself or permit the adding of weight if needed to force accurate and even penetration of the sweeps. Sufficient weight to accomplish this will not add greatly to the draft of the implement but will mean much in its successful operation. These are features commonly overlooked or neglected in most commercial or homemade machines. With respect to rigidity, weight and control of penetration, this implement must compare with the plow and not the duckfoot cultivator in order to be successful.

A LARGE ROLLING COULTER SHOULD BE USED AHEAD OF EACH SWEEP FOR BEST RESULTS

The implement must lend itself to accurate and stable adjustment both for depth and pitch of sweeps. This is to permit adjustment of sweeps for lowest draft and smoothest operation for given soil conditions and to permit operation at a uniform desired depth.

A large rolling coulter (at least 15 in in diameter) with swivel attachment and sharp blade should be used ahead of each sweep for best results. Coulters are essential when operating in weeds or residue in order to clean a path for the sweep shank and thereby prevent dragging of trash and possible clogging of the machine.

A strongly constructed power lift with dependable action is a valuable addition to the machine. It will be of great help in cleaning the machine in case it does become loaded with trash. It must operate properly even when the machine is weighted.

The most practical width of a stubble-mulch implement will vary with the agricultural area. However, for most suitable operations, there is a limit to the width of most tillage tools of rigid construction even on relatively level fields. For a sweep implement, where uniform depth of penetration is important, this width is between 10 and 12 ft. If the power unit being used will accommodate more load than furnished by one implement of this size, then two units should be used. The flexibility provided by two small units as compared to one wide unit gives more uniform penetration and leaves a more uniform stubble mulch.

Operators who have a tractor-attached tool bar, similar to the Minneapolis-Moline AQA-1 attacher with tool bar, can attach the sweeps to it and satisfactorily till land provided it has been previously tilled with sweeps one or more times. Where this practice can be used, there is some saving in draft because the load is carried on the tractor and the drag of an additional implement is eliminated. It must be remembered, however, that proper spacing and staggering of sweeps and the use of rolling coulters are as essential for tractor-attached tool bar operation as when the sweeps are used on the special machine. Because of the lack of weight and positive-depth control of the sweeps with most tractor-attached tool bars available in the past, this arrangement could not be made to work satisfactorily for the first and sometimes the second operation. Difficulties commonly encountered usually increase as positive control of sweeps decreases.

The items mentioned above may appear more or less trivial but the lack of any one or more of them may cause the implement to give unsatisfactory results under difficult conditions of soil and cover whereas, under favorable conditions, they might not be essential. Chase[1] reports that, of the 100 to 150 fields in which he had an opportunity to work with subsurface tillers, probably not more than a half dozen could be classed as suitable for subsurface tilling. He found the same condition encountered by most of those who have worked with subsurface or stubble-mulch tillage on farms. The soil was too hard or too loose, too wet or too dry, or there was a loose layer of soil on top with a very hard layer beneath, or the fields were densely covered with all sorts of weeds. Whether the existence of such conditions can be assigned to lack of understanding or carelessness on the part of the farmer or to unavoidable circumstances caused by weather, shortage of help or some other cause, they will always be present to some degree in all communities. These difficulties can be reduced by educating the farm operator but the success of stubble mulching on a broad scale will depend more on developing an implement that will do satisfactory work under adverse conditions. The suggestions made above represent only a few of the many that may be needed before success is obtained.

Stubble-mulch tillage on the scale needed to protect the High Plains against soil blowing will not be satisfactorily accomplished by attempting to get farmers to use various types of sweeps that they might attach to some implement they may have on hand and use for some other purpose. In most cases, such sweeps are very difficult to adjust properly and will not operate to the farmer's satisfaction and he will discard them as he has discarded many implements in the past.

Stubble mulching entails a specific type of tillage and is a practice which has great potential value to Great Plains agriculture. The practice, therefore, is worthy of a special implement to do the job. There is ample evidence to show that only by use of a special implement embodying all the requirements essential for satisfactory operation will the practice spread sufficiently to be of widespread benefit to the Plains.

There is no implement available on the market at the present time which, to our knowledge, fulfills all the requirements set forth in this discussion and meets the practical need of this area. We are attempting to develop a machine to incorporate most of these features and we hope that others may be working on this same problem. We have just completed and are now using a machine which appears to have several advantages over machines used in the past. It is not our belief that stubble-mulch implements will supplant all others, but the practice appears to have a real value in the Southern High Plains and, perhaps, should be employed whenever possible and practical.

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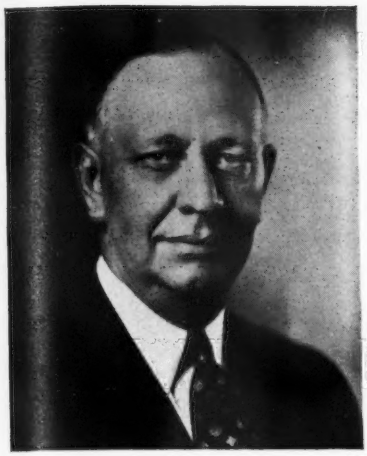
America Needs Engineers

A TASK which should have immediate attention and high priority on the part of the people of the United States is that of education in all its aspects and at all levels. Especially must engineering education receive support because America needs engineers. Education at primary and secondary-school levels has popular and public support. . . . When it comes to education at the college level, we can look back with encouragement to the great increase in registrations since World War I. Opportunities for young people to attend college have been fairly abundant and the question frequently has been raised as to whether we may not have gone in for quantity at the expense of quality. Wiser selection of material, higher standards of attainment, and more money spent to attract and hold better teachers are means for improving quality. . . . . Our task now is to bend every effort to make up for the lack of men with scientific and engineering training that wartime conditions have created. — Editorial in "Mechanical Engineering" for June, 1945.

The 1945 A.S.A.E. Gold Medalists



C. H. WHITE

The American Society of Agricultural Engineers awarded the John Deere Medal to Charles Harold White and the Cyrus Hall McCormick Medal to Charles Abel Bennett on the occasion of its annual dinner on June 5, held at Chicago, Illinois

C. A. BENNETT

FOR the first time since its creation, the John Deere Gold Medal award for 1945 is being conferred on a man connected with the great farm implement company bearing that name. It is one of many times that the Jury of Awards of the American Society of Agricultural Engineers has chosen a man whose contribution to agriculture is measured not by a single spectacular achievement but rather by a lifetime of devotion to a well-defined purpose.

Charles Harold White was born May 1, 1885, the son of Charles E. White, at Moline, Illinois. He attended the grade and high schools of that city, and later the University of Wisconsin where his work in mechanical engineering was varied by a semester of law. His fraternity there was Sigma Alpha Epsilon.

However, the bent whereby the tree is inclined took form when he was indeed but a twig. When he was eight he watched with more than a small boy's usual curiosity while his father, working in a little shop in his barn, designed a corn planter. Step by step the boy observed the shaping of patterns, the fabrication of steel parts, the fitting and assembly of parts into a complete machine. He followed it to the field for performance tests, and henceforth his life pivoted mainly around the creation and production of planting equipment.

Likewise early was his initiation into industry. As a high school senior he contrived to attend classes only in the morning. Afternoons and Saturdays, as well as vacations, he worked in the nearby Sylvan mill of the Republic Iron and Steel Company. During his vacations from the university he worked in the Deere and Mansur plant of Deere and Company. In 1907 he began the full-time work with that concern which developed into his lifetime career. He started as a molder, and the things he molded were seed plates for corn planters.

In about eighteen months he was transferred to the experimental department. Here he came under the direction of his father, who was general superintendent of the plant, an association which continued until the father's retirement in 1917. The following year "Polly," as the younger White is known to his familiars, was made superintendent of the Deere and Mansur Works.

During the decade with his father he was responsible for the development of a famous planter, the John Deere No. 999. He did the experimental work, supervised the details of pattern making, and followed the machine far and wide to prove and perfect it in countless conditions of seed, soil, and season. Being raised to executive rank never weaned him from his love of experimental development, notably of planting machinery. To this day he is more in field and factory that at his desk.

Mr. White became a member of the American Society of Agricultural Engineers in 1920, and he has been one of the Society's representatives on the National Joint Committee on Fertilizer Application from its inception in 1925 up to the present. He was instrumental in creation of the safety *(Continued on page 258)*

"IF WE can say Eli Whitney and Hodgen Holmes are the fathers of the saw gin and the gin saw, respectively, then Mr. Bennett is the father of modern and improved ginning, cleaning and drying methods."

In that remark by a man who knows him well are epitomized a record in the renaissance of cotton, the consensus of his colleagues, and no doubt the reasons which guided the Jury of Awards of the American Society of Agricultural Engineers as they chose Charles Abel Bennett to receive the Cyrus Hall McCormick Gold Medal for 1945.

He was born November 14, 1889, at Tecumseh, Nebraska. He claims to be half Yankee because his heritage on the paternal side stems from the Rogers family who made silverware in Connecticut for more than a century; half Southern through his mother and the Hurd and Noble families who were Confederates "down around Natchez." Also, his mother was a Holmes, and her grandfather was the first lieutenant-governor of Wisconsin. On both sides his ancestry runs back to soldiers of the American Revolution.

His education included graduation from the Lincoln, Nebraska, high school and in 1911 the bachelor's degree in mechanical engineering from the University of Nebraska. While there he was cadet captain of Company C; also of the Pershing Rifles, a unit founded by General Pershing while he was commandant at Nebraska. Mr. Bennett also was first to receive the Pershing Medal, inaugurated while the general was in the Philippines.

After a brief period as draftsman for the Omaha Power and Light Company and the Omaha Machine Works he was, from 1913 to 1917, a member of the consulting engineering firm of Anderson and Bennett; for the latter two years also heating and ventilating engineer for the Omaha public schools. Then, until 1922, he was a supervising draftsman with the machinery division of the U. S. Navy Yard at Puget Sound; and he was president of the Navy Yard organization of supervisors for the year 1921. His assignments included important work on submarines, conversion of ships from coal to oil fuel, transformation of passenger ships, including the "Great Northern" and "Northern Pacific" luxury liners, to troop carriers, and the preparation of many piping layouts for battleships, cruisers, destroyers, and mine sweepers. Between 1922 and 1926 Mr. Bennett was successively a registered engineer at Portland, Ore., and a designer of fluid meters at Alhambra, Calif.

Then he began his career in cotton. For four years he was associate engineer in cotton drying with the USDA Division of Agricultural Engineering at Tallulah, La. When, by congressional enactment, the USDA Cotton Ginning Laboratory was established in 1930 at Stoneville, Miss., he was made senior engineer in charge, the position he still holds. The notable engineering achievement of that institution, both in technical developments and in their prompt adoption by agriculture and industry, is mainly the fruit of his guidance and leadership. *(Continued on page 258)*

NEWS SECTION

Long Heads A.S.A.E. for 1945-46

JAMES DEWEY LONG, director of education and market research, Douglas Fir Plywood Association, became the new president of the American Society of Agricultural Engineers at the close of the Society's annual dinner held at the Stevens Hotel, Chicago, on June 5th. He succeeds R. H. Driftmier, head of agricultural engineering department at the University of Georgia.

J. DEWEY LONG

Mr. Long is a native of Decatur, Iowa. Prior to receiving his bachelor of science degree in agricultural engineering at Iowa State College in 1922, he was farm mechanics teacher for one year at the Fayette, Iowa, high school and shop instructor for one year at the Nevada, Iowa, high school. Also, during 1921 he served six months as extension draftsman on farm buildings at Kansas State College. On graduation he joined the agricultural engineering staff of the University of California at Davis where he served as assistant professor of agricultural engineering and assistant agricultural engineer in the agricultural experiment station until 1940. In 1928 he received his master's degree in agricultural engineering from the University of California.

In 1940 Mr. Long joined the Douglas Fir Plywood Association as agricultural engineer; and later he was advanced to the position of head of the research department of the Association.

Early in his career, Mr. Long chose farm structures as his specialty, and he is counted among outstanding specialists in that branch of agricultural engineering. He has served as chairman of the Farm Structures Division of A.S.A.E., and has taken a prominent part in various Society committee activties, mostly in the farm structures field. The latest committee assignment which he carried out with distinction was chairman of the A.S.A.E. Committee on Paper Awards referred to elsewhere in this issue.

Mr. Long is the author of several California bulletins on farm structures and of numerous articles on the subject in the A.S.A.E. Transactions and AGRICULTURAL ENGINEERING. In addition to his A.S.A.E. membership he is also a member of the Association for the Advancement of Science, the Society for the Promotion of Engineering Education, and the Institute of Food Technologists.

Dinner Completes A.S.A.E. Year

FOLLOWING a meeting of the Council and the Cabinet of the American Society of Agricultural Engineers, during the forenoon and afternoon of June 5th, the A.S.A.E. Annual Dinner, the high point of the Society's annual meetings, was held the same evening at the Stevens Hotel, Chicago, with the Chicago Section of the Society acting as host for the occasion. A total of 140 persons attended the dinner, mostly members of the Society and in the main from the Chicago area.

The program for the dinner was opened by Arthur W. Farrall, chairman of the Chicago Section, with cordial words of welcome to visiting members and guests, following which the President of the Society, R. H. Driftmier, conferred the Society awards, including the John Deere Gold Medal to C. H. White and the Cyrus Hall McCormick Gold Medal to C. A. Bennett. The first of the new A.S.A.E. Paper Awards were also conferred on eleven recipients, referred to elsewhere in detail in this issue.

At the completion of conferring the awards, Section Chairman Farrall again introduced President Driftmier, who delivered the president's annual address on the subject "Postwar Opportunities in Agricultural Engineering," which will be published in full in AGRICULTURAL ENGINEERING for July.

Following his address, President Driftmier then introduced a distinguished member of the Society from Great Britain, Mr. S. J. Wright, director of the National Institute of Agricultural Engineering of the British Ministry of Agriculture and Fisheries, who made a very delightful talk on some of the agricultural problems of Great Britain with particular reference to their agricultural engineering aspects.

A.S.A.E. Paper Awards

AT its meeting in June, 1944, the Council of the American Society of Agricultural Engineers voted to establish the "A.S.A.E. Paper Awards," the purpose of which is "to encourage Society members to strive constantly to augment and to raise the standard of agricultural engineering literature by means of annual awards for papers of superior merit."

The rules for the awards provide for a committee of the Society, to be known as the Committee on Paper Awards, which consists of six members, two of whom retire each year and are replaced by two new members appointed by the President with the approval of the Council. In initiating these awards, provision was made for the maximum of ten awards to be made in 1945. Thereafter, however, they will be limited to a maximum of five each year.

Selections for these awards will be made only from papers and articles published in AGRICULTURAL ENGINEERING, the journal of the Society, of which A.S.A.E. members are the sole or principal authors, and will include both articles prepared expressly for AGRICULTURAL ENGINEERING and addresses, papers, and reports presented before national, regional, section, or division meetings of the Society. Papers or articles that have been contributed elsewhere, in the same or similar form and prior to publication in AGRICULTURAL ENGINEERING, will not be eligible for these awards.

Also, the awards will be made for contributions to agricultural engineering literature of exceptional merit. To be eligible for this award, a paper need not cover original work. It may be a review of literature, a history of the development of some phase of agricultural engineering, a treatise developing the theory of some process or operation or piece of equipment, a description of a research project, or any similar treatment of a subject with agricultural engineering connotations. In the selection of papers for the awards, major emphasis will be given to their value as contributions to the literature of their particular field or subject and to the quality of their contributions to the advancement of agricultural engineering as a whole and its value to civilization. Particular credit will be given to papers which bring to their subject matter a fresh point of view, open-mindedness or a discarding of wornout theories and traditions. While credit will be given to brevity and conciseness in papers, it is important that these not be attained at the sacrifice of unity and completeness of presentation.

The awards will be made only to members of the Society, and provision is made for each recipient to receive a suitable token of the award. In case two or more Society members are designated as joint authors of a paper selected for the award, each author will be considered a recipient. In addition, each recipient will receive a receipt for one year's paid-up membership in the Society.

The Committee on Paper Awards which made the 1945 awards consisted of J. D. Long (chairman), E. L. Barger, M. H. Lloyd, I. D. Wood, F. W. Peikert, and S. A. Witzel, and as provided in the rules for the awards, the ten initial awards were based on papers published in AGRICULTURAL ENGINEERING during the calendar years 1940 to 1944, inclusive. The awards were formally made by the President of the Society, R. H. Driftmier, on the occasion of the Society's annual dinner held at the Stevens Hotel, Chicago, on June 5.

Heading the list of recipients was Dr. J. Brownlee Davidson, head of the agricultural engineering *(Continued on page 254)*

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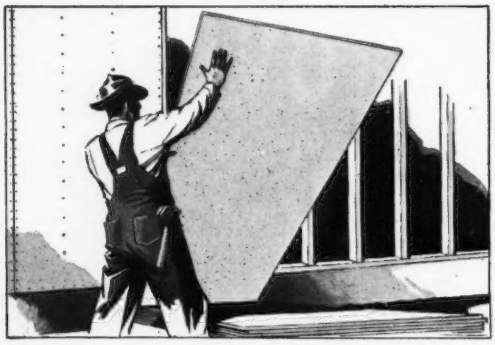

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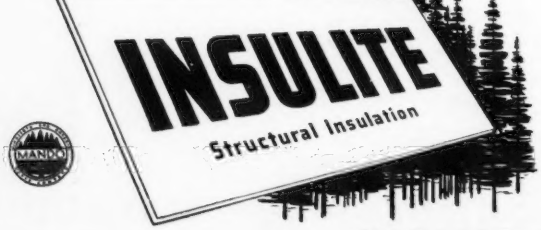


Made Exclusively From Wood

NEWS SECTION

(Continued from page 252)

department, Iowa State College, who won two citations, one as one of the authors of the series of ten papers, with the general title "Transportation Wheels for Agricultural Machines," which appeared in AGRICULTURAL ENGINEERING in consecutive issues beginning November, 1939, to and including August, 1940. The second citation to Dr. Davidson was for the paper, entitled "Agricultural Engineering," published in AGRICULTURAL ENGINEERING for December, 1944.

Second on the list of recipients was Dr. Eugene G. McKibben, newly appointed agricultural engineer of the Pineapple Research Institute of Hawaii, who was selected as one of the joint authors of the series of articles, "Transport Wheels for Agricultural Machines." In his note of acceptance of this award, Dr. McKibben wrote "Graduate student co-authors J. J. Thompson, Robert L. Green, and Dale O. Hull deserve honorable mention in connection with this award, as they did the work which made this series of articles possible."

Leonard J. Fletcher, director of training, Caterpillar Tractor Co., was given the award for his paper, entitled "Machines and Jobs," published in the March, 1941, issue of AGRICULTURAL ENGINEERING.

Rene Guillou, formerly a member of the agricultural engineering research staff of the University of California at Davis, and now serving as chief engineer water division, Transportation Corps, U. S. Army Transport, was cited for his paper, entitled "Developments in Fruit Dehydrator Design," published in AGRICULTURAL ENGINEERING for October, 1942.

Austin W. Zingg, associate soil conservationist, U. S. Soil Conservation Service, was given an award for his paper, entitled "Degree and Length of Land Slope as It Affects Soil Loss and Runoff," which appeared in AGRICULTURAL ENGINEERING for February, 1940.

James L. Strahan, agricultural engineer, Flintkote Co., received the award in recognition of his paper, "A Rational Approach to Poultry House Design," published in AGRICULTURAL ENGINEERING for September, 1940.

Robert A. Norton, soil conservationist (research), U. S. Soil Conservation Service, and Edgar V. Collins, research professor of agricultural engineering, Iowa Agricultural Experiment Station, were each given the paper award as two of the authors of the paper, entitled "Present Status of the Plow as a Tillage Implement," published in AGRICULTURAL ENGINEERING for January, 1944.

Deane G. Carter, professor of farm structures, University of Illinois, was cited for the paper, "The Relation of Farm Structures to Agriculture," appearing in AGRICULTURAL ENGINEERING for August, 1944.

Henry Giese, professor of agricultural engineering, Iowa State College, was given the award for his paper, entitled "Rural Fire Prevention," published in AGRICULTURAL ENGINEERING for April, 1942.

Edgar L. Barger, professor of agricultural engineering, Iowa State College, received the award in recognition of his paper, entitled "Power Alcohol in Tractors and Farm Engines," published in AGRICULTURAL ENGINEERING for February, 1944.

Personals of A.S.A.E. Members

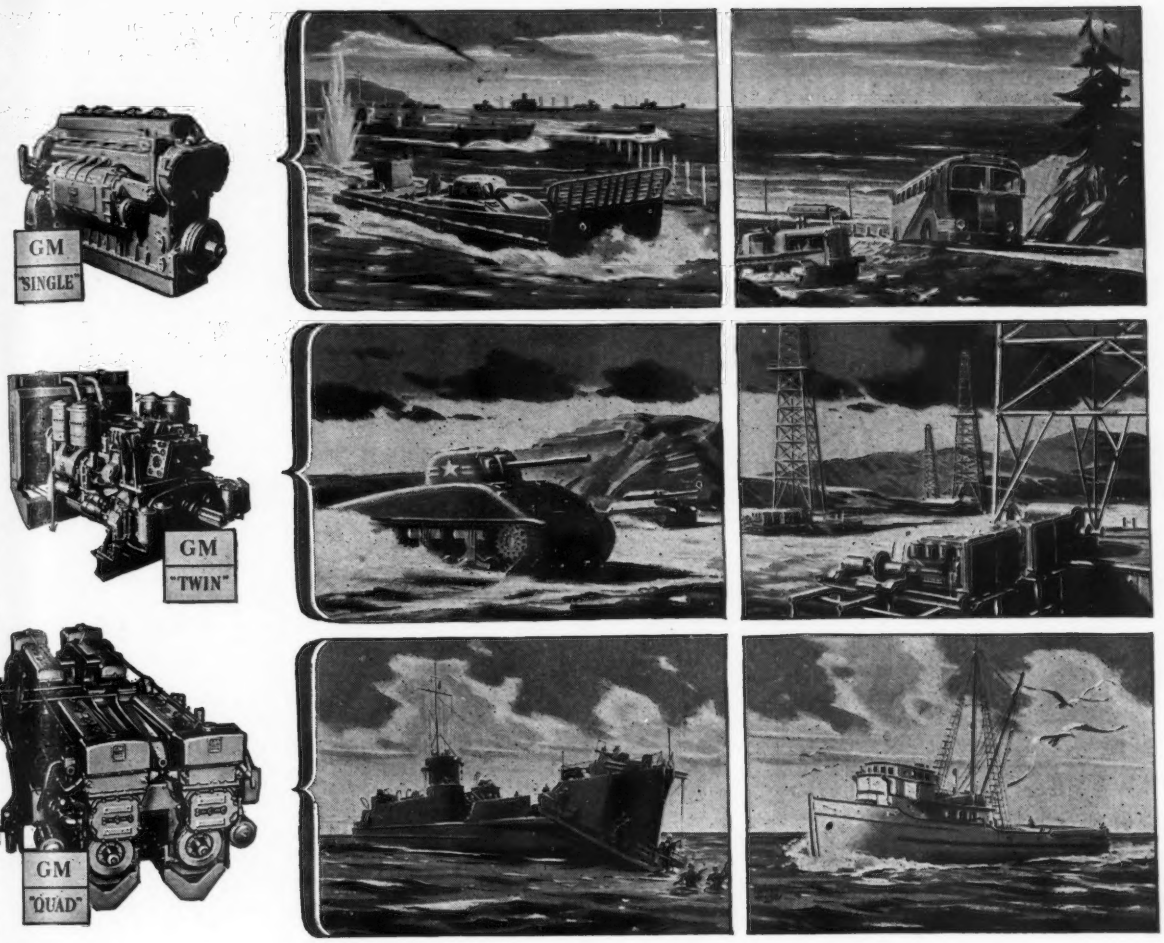
Howard F. Carnes, formerly assistant mechanical engineer, fiber flax machinery investigations, USDA Bureau of Plant Industry, Soils, and Agricultural Engineering, joined the staff of Oregon State College on June 1 as research agricultural engineer, and will be engaged in the study of labor-saving equipment and also on hay drying research.

Albert S. Curry, who has been engaged in irrigation research work at the New Mexico Agricultural Experiment Station, is now serving as acting director of the Station.

Ellis G. Diseker, drainage engineer, Soil Conservation Service, U. S. Department of Agriculture, has moved his headquarters from Auburn, Alabama, to Raleigh, N. C., where he will be engaged as project supervisor in drainage research work in North Carolina, cooperating with the department of agricultural engineering of the North Carolina Agricultural Experiment Station.

C. W. DuBois has resigned as assistant professor in charge of food preservation, Louisiana Agricultural Experiment Station, to engage in a private consulting business in the field of food technology at West Port, Connecticut, in which he will be associated with *Dr. D. K. Tressler.*

(Continued on page 256)



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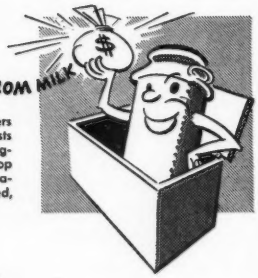

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NEWS SECTION

(Continued from page 254)

Kenneth R. Frost is now employed as design engineer at the Bean-Cutler Division of the Food Machinery Corporation at San Jose, Calif. His work will deal with the design, construction, and testing of agricultural machinery. He was previously assistant professor of agricultural engineering at the University of Idaho.

Norton C. Ives has resigned as extension agricultural engineer at Iowa State College to accept a position in charge of agricultural engineering work at the Inter-American Institute of Agricultural Sciences at Turrialba, Costa Rica. This institution is being established by the twenty-one American republics and its purpose is primarily to do research, teaching and extension work in tropical agriculture. It is expected that students will be drawn from all the 21 countries participating. All students attending must have a bachelor of science degree and their main activities at the Institute will be to engage in research in some phase of tropical agriculture.

Lamar M. Kishlar, manager of research, Ralston Purina Company, was elected last month as a member of the governing board of the American Oil Chemists Society.

H. P. Smith, chief, agricultural engineering division, Texas Agricultural Experiment Station, who was appointed a year ago to represent the A.S.A.E. on the Library Board of the Texas Natural Resources Foundation, has been further honored by appointment as vice-chairman of the Board and also as chairman of the Budget Committee.

Clarence E. Stevens, Jr., recently resigned as agricultural engineer, J. J. White, Inc., and is now engaged in soil conservation work for the Seabrook Farms Co., of Bridgeton, N. J.

Francis D. Yung, research engineer in rural electrification, University of Nebraska, is author of Agricultural Engineering Progress Report No. 11, entitled "A 3-Zone Farm Refrigerator," issued last month by the Nebraska Agricultural Experiment Station.

Applicants for Membership

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Joseph Ackerman, associate managing director, Farm Foundation, 600 S. Michigan Ave., Chicago 5, Ill.

Vernon C. Botsford, assistant conservationist, Soil Conservation Service, USDA. (Mail) 607 5th St., No., Fargo, N. D.

L. George Coonrod, Lt.(jg), USNR. (Mail) USS LST 735, c/o FPO, San Francisco, Calif.

Louis Decatrel, director general of agriculture, Haiti Department of Agriculture. (Mail) Pacot, Port au Prince, Haiti, W. I.

Robert K. Derry, rural service supervisor, The Ohio Power Co., 301-315 Cleveland Ave., SW, Canton 2, Ohio

Glenn K. Downing, agricultural field engineer, The Louden Machinery Co. (Mail) De Graff, Ohio

Eugene I. Kirkland, product development engineer, National Milker Co., Des Moines, Iowa. (Mail) 3911 Glover Ave.

K. W. Pike, Farm Equipment Institute, 608 S. Dearborn St., Chicago 5, Ill.

R. P. Speed, engineer, Proctor & Gamble Defense Corp., Prairie, Miss.

Fred O. Weldon, manager, cotton industry sales, Le Roi Co. (Mail) 802 Brown St., Waxahachie, Tex.

TRANSFER OF GRADE

Everett H. Davis, irrigation engineer, Soil Conservation Service, USDA. (Mail) P.O.Box 101, Fort Collins, Colo. (Associate to Member.)

Lee H. Ford, supervisor, war products service division, International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. (Associate Member to Member.)

R. P. Frey, supervisor, farm sales promotion, Imperial Oil Ltd., Saskatoon, Sask., Canada (Junior Member to Member.)

W. A. Pohlman, president, National Electric Screen Corp. (Mail) 549 W. Washington, Chicago 6, Ill. (Associate to Member.)

George H. Larson, assistant aeronautical engineer, USN. (Mail) RR No. 1, Box 58, Lindsborg, Kans. (Junior Member to Member.)

Arthur H. Schulz, Lt., USA. (Mail) 511 Bomb. Sq., 351st Bomb. Gr. (H), APO 557, c/o Postmaster, New York, N. Y. (Junior Member to Member.)

There's something familiar about the

Bank of Guam

Yes — it's another Quonset Hut

Not long ago the Bank of Guam consisted of ten crates, stowed with others in the hold of a ship bearing supplies to advanced base headquarters of the Pacific Ocean area. In these crates were the component parts that make up a Quonset Hut — lightweight Stran-Steel framing, metal roofing and siding, nails, bulkheads, electric wiring and fixtures, ventilators, windows, door panels.

At that point, no one in this wide world could have told how this particular group of ten crates—this particular Quonset Hut—would serve. It might have become a barber shop—or a barn . . . a barracks building—or a bakery . . . a communications building—or a bomb assembly shed. "You name it, we'll build it" is the Seabees' attitude when the Quonset Hut crates hit the beach!

And so, it became the Bank of Guam!

Tens of thousands of Quonset Huts have been produced by the Great Lakes Steel Corporation to house men, materials and operations at our Pacific bases. So varied are their uses, so vast their application, that they have become the very symbol of American progress against Japan . . . the milestones on the road to Tokyo.

Back the 7th War Loan . . . Buy War Bonds

GREAT LAKES STEEL CORPORATION

STRAN-STEEL DIVISION • 37TH FLOOR PENOBSCOT BUILDING • DETROIT 26

UNIT OF NATIONAL STEEL CORPORATION

STRAN-STEEL

Material of Tomorrow's Farm Buildings

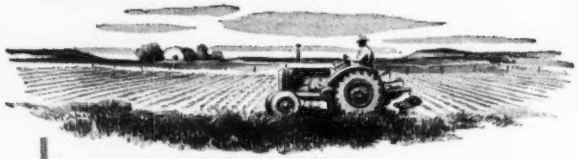
Look to Great Lakes Steel Corporation for better values in better farm buildings when our wartime assignment is completed. Stran-Steel farm buildings go up faster, stay up longer . . . resist rot, warp, sag and termites . . . permit fire-safe construction. Stran-Steel Quonset Huts gave the Navy what it wanted; Stran-Steel farm buildings will give you what you want.

FARM BUILDINGS

FRAMING FOR HOMES

COMMERCIAL AND INDUSTRIAL BUILDINGS

YOU NAIL TO STRAN-STEEL



IN COOPERATION with the leading tractor manufacturers Purolator makes specially designed tractor oil filter elements to fit each make of tractor. These specially designed elements increase the oil filter's efficiency in removing motor-damaging dirt, dust, grime and abrasives from lubricating oil. Purolator makes all types of filter replacement elements to fit all types of oil filters. In fact, Purolator makes and sells more tractor oil filters and tractor oil filter elements than all the rest of the oil filter industry combined. We are always glad to consult with agricultural engineers on problems of oil filtration, especially those relating to scientific farming. Purolator Products, Inc., founder and leader of the oil filter industry, Newark 2, N. J. In Canada: Purolator Products (Canada), Ltd., Windsor, Ont.

KEEP IT CLEAN WITH
PUROLATOR
THE OIL FILTER

C. H. White—1945 Deere Medalist

(Continued from page 251)

fertilizer attachment for corn planters, which placed the plant food in bands beside the seed, and its introduction to the market as early as 1926. More recently he directed the development of a planter with a new type of valves which operates with practical accuracy up to five miles an hour and thereby breaks one of the bottlenecks in the spring rush of farm work, as well as taking advantage of the speed inherent in tractor power and rubber tires.

According to his associates, Mr. White is "from Missouri," hard to sell by say-so, insistent on practical demonstration. Instinctively of inventive rather than theoretical temperament, he nevertheless has become one of the most widely read men in all the phases of agriculture related to planting and tillage machinery, an obviously broad field. He is in his own right an acknowledged authority in the complex subject matter of fertilizer application and utilization.

Not counting applications still pending, Mr. White has been granted 85 United States patents, all in the realm of farm machinery, and most of them concerned with progress in disk harrows and planting machinery. In addition to all this creative work he has advanced along executive lines to managership of the Deere and Mansur Works in 1937 and to directorship in Deere and Company the following year.

C. A. Bennett—1945 McCormick Medalist

(Continued from page 251)

At this point, enumeration becomes impossible and even summary is difficult. Likewise is any attempt at boundary between Mr. Bennett and the Laboratory. For example, he is credited with nine public service patents and the Laboratory with twenty, the latter covering devices used by more than 3,000 ginners.

According to his own appraisal, Mr. Bennett's outstanding contributions to American agriculture are the cotton drying process and the sum total of influence on the industry, based upon research and made possible through broad personal contact with leaders and members of all state and national ginners' associations and close cooperation with the ginning machinery manufacturers.

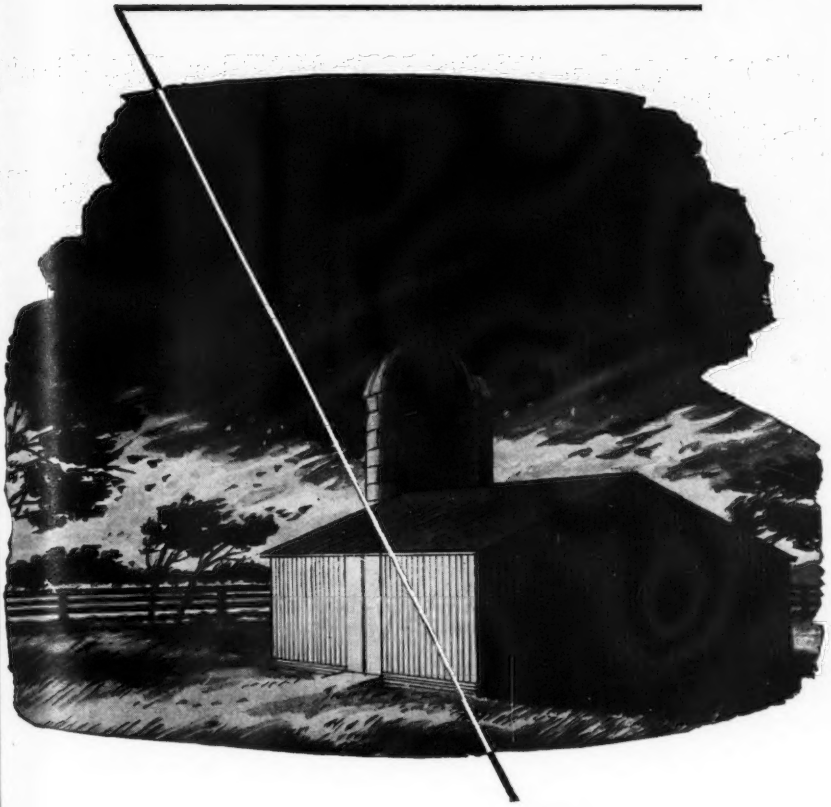
In a recent summary of achievement by the Stoneville laboratory, Past-President Arthur W. Turner of the A.S.A.E. mentioned, in addition to the public service patents, that by 1944 the "government-process" driers had been installed in gins with a combined capacity of half the nation's cotton crop; creation of a device which prevents "air cuts" responsible for damage to 3,000 bales per year; engineering improvements which reduce gin power requirements by 15 per cent; and operating methods which prolong the useful life of gin machinery by five years.

Few if any other members of the profession have been so prolific in contribution to its literature, at least in so short a time. In a list before us we note with some pride that the earliest entry, for October, 1928, covers a paper in AGRICULTURAL ENGINEERING relating to simplified pitot tube calculations on air ducts, and the next is an A.S.A.E. Transactions paper the following summer, dealing with cotton drying experiments.

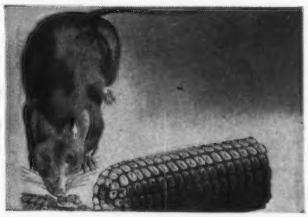
Thenceforward his writings not only were numerous, but multiple publication was more the rule than the exception, ranging from mimeographed releases through bulletins and trade papers to the USDA Yearbook. His paper on the relation of mechanical harvesting to production of high-grade cotton, given at the A.S.A.E. annual meeting in 1938, besides being mimeographed and published in AGRICULTURAL ENGINEERING also appeared in four trade journals. Including those of which he is a joint author, the list to the close of 1944 comprises 264 publications, all pertaining to cotton and its ginning or drying.

As if all this were not enough to take up his time and talent, Mr. Bennett has been active in Freemasonry and in building construction. In the one he holds the coveted 33rd degree, has a notable library of Masonic writings, and is in his own right an authority on Scottish Rite Masonry. While at Tallulah, without remuneration he designed the Masonic Temple, the Methodist Church, the Montgomery Hotel Annex, and government buildings for the Bureau of Entomology. Since being stationed at Stoneville he has continued architecture as a hobby, mainly in the gratis designs for Masonic temples. *(Continued on page 264)*

FIRE IN THE NIGHT!



For low-cost protection against lightning, properly grounded steel buildings will do the job.



For low-cost protection of stored grains from rats, you can't beat steel.

For low-cost protection for livestock against wind, rain, and snow, you can't beat steel roofing and siding.

You can't beat Steel for protection

FLYING embers from brush or grass fires seldom damage a building shielded with steel roofing and siding. Steel doesn't burn and offers effective protection for farm buildings, stored crops and livestock.

A steel roof, properly grounded, makes an excellent shield against lightning. It also protects against rain, snow, hail, sleet and wind.

In farm machinery, steel adds strength and ruggedness. Special U·S·S Alloy Steels increase resistance to wear and breakage. U·S·S Copper Steel increases atmosphere rust resistance two to three times.

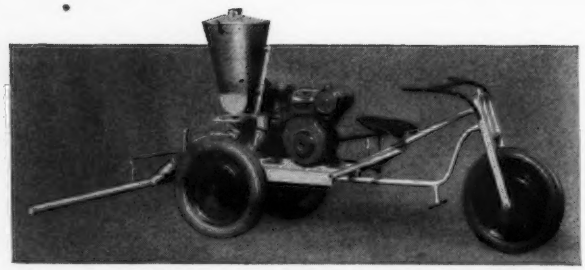
When planning farm buildings or farm machinery, recommend steel—no other material can do so many jobs so well.

U·S·S Steel Roofing and Siding

CARNEGIE-ILLINOIS STEEL CORPORATION, *Pittsburgh and Chicago*
COLUMBIA STEEL COMPANY, *San Francisco*
TENNESSEE COAL, IRON & RAILROAD COMPANY, *Birmingham*
AMERICAN STEEL & WIRE COMPANY, *Cleveland, Chicago and New York*
United States Steel Export Company, New York

USS STEEL — UNITED STATES STEEL

UNITED STATES STEEL



Another WISCONSIN *Air-Cooled* ENGINE

Farm Equipment Application

This self-propelled Riding Duster, made by the Hayden Manufacturing Co., of Wareham, Mass., is powered by a Model AK Wisconsin 4-cycle single engine (3 to 4 hp.), and has a dusting capacity of 20 to 25 acres per 8-hour day. This is another typical adaptation of Wisconsin air-cooled engine power to agricultural operations. The heavy-duty engine weighs only 77 lbs. and provides adequate power for operating both the dusting mechanism and propelling the machine over rough ground.

Wisconsin Air-Cooled Engines are made in 14 different sizes, single cylinder and 4-cylinder "V" types, in a power range of 1 to 30 hp.

Most H.P. per pound WISCONSIN MOTOR Corporation
MILWAUKEE 14, WISCONSIN, U. S. A.
World's Largest Builders of Heavy-Duty Air-Cooled Engines

Is "SEAT-FAG" still a "BUG" IN YOUR EQUIPMENT?

EVERY tractor or riding implement that is equipped with an old-fashioned hard iron seat carries with it a Seat Fag "Bug" that causes costly work-loss through reduced efficiency of the operator.

You can correct this condition to a very considerable degree by replacing your uncushioned implement seats with MILSCO CUSHION SEATS, which are designed primarily to provide the maximum degree of comfort and working efficiency for the operator. Milsco Cushion Seats can be specifically adapted to your individual equipment designs.

Write for your copy of Milsco File Folder 44-A which presents helpful data on this vital subject.

MILSCO MANUFACTURING CO.
2758-A N. 33rd Street Milwaukee 10, Wis.

Milsco MILWAUKEE Cushion Seats FOR FARM AND INDUSTRIAL EQUIPMENT

EMPLOYMENT BULLETIN

The American Society of Agricultural Engineers conducts an employment service especially for the benefit of its members. Only Society members in good standing may insert notices under "Positions Wanted," or apply for positions under "Positions Open." Both non-members and members seeking to fill positions, for which ASAE members are qualified, are privileged to insert notices under "Positions Open," and to be referred to members listed under "Positions Wanted." Any Notice in this bulletin will be inserted once and will thereafter be discontinued, unless additional insertions are requested. There is no charge for notices published in this bulletin. Requests for insertions should be addressed to ASAE, St. Joseph, Michigan.

POSITIONS OPEN

ASSOCIATE AGRICULTURAL ENGINEER wanted by New Mexico College of Agriculture and Mechanic Arts for research and teaching relative to irrigation, farm structures, and electricity. Salary depends on qualifications and experience. Write direct to Agricultural Experiment Station, State College, New Mexico.

RANCH MANGER wanted. Dried fruit and general farming on a California farm which is 100 per cent mechanized, 100 per cent irrigated by pipe lines, 100 per cent developed. This is a manufacturing proposition requiring the skill of a thoroughgoing agricultural engineer experienced in western ways of farming. Living conditions, soil type, water conditions, proximity to the city - all of the best. Schools and colleges not far distant. Applicants will please give full statement, including age, education, health, family details, religious convictions, experience in detail, and other information in detail, also a photograph, in the first letter. PO-185

AGRICULTURAL ENGINEERS wanted for temporary and permanent positions in Latin America. Knowledge of Spanish desirable but not mandatory. Experience in the fields of soil conservation, drainage and irrigation. Salary and expense allowances. Write in detail, stating age, experience and when available. Address reply to Box 435, Ben Franklin Station, Washington, D. C.

DRAFTSMAN wanted. Mechanical or structural experience desired. Excellent opportunity for one who can show ability as a designer in the farm equipment and farm structures field. PO-184

AGRICULTURAL ENGINEER wanted by large muck land operator to improve and develop farm machinery for large operations. Good permanent setup for a practical engineer. PO-183

AGRICULTURAL SALES ENGINEER wanted. Applicants will please state age, educational background, practical experience, and send photograph. Also state earnings expected and whether or not presently employed and with whom. A good job for the right party with opportunity for advancement with a fast-growing organization. PO-182

ENGINEERING ACCOUNTANT required by an American firm for Venezuela, who can speak and write Spanish. Experience in earth-moving or grading desirable. Duties include simple construction costs and office management. Position permanent. Norman DeWind, 949 Shoreham Building, Washington, D. C.

ASSISTANT AGRICULTURAL ENGINEER wanted for research in farm structures, equipment, and utilities. Equal division between college of agriculture and agricultural experiment station, including cooperative projects with industry and public utilities. Salary depends upon qualifications and experience. Give full particulars, including military status with application. University of Idaho. PO-181

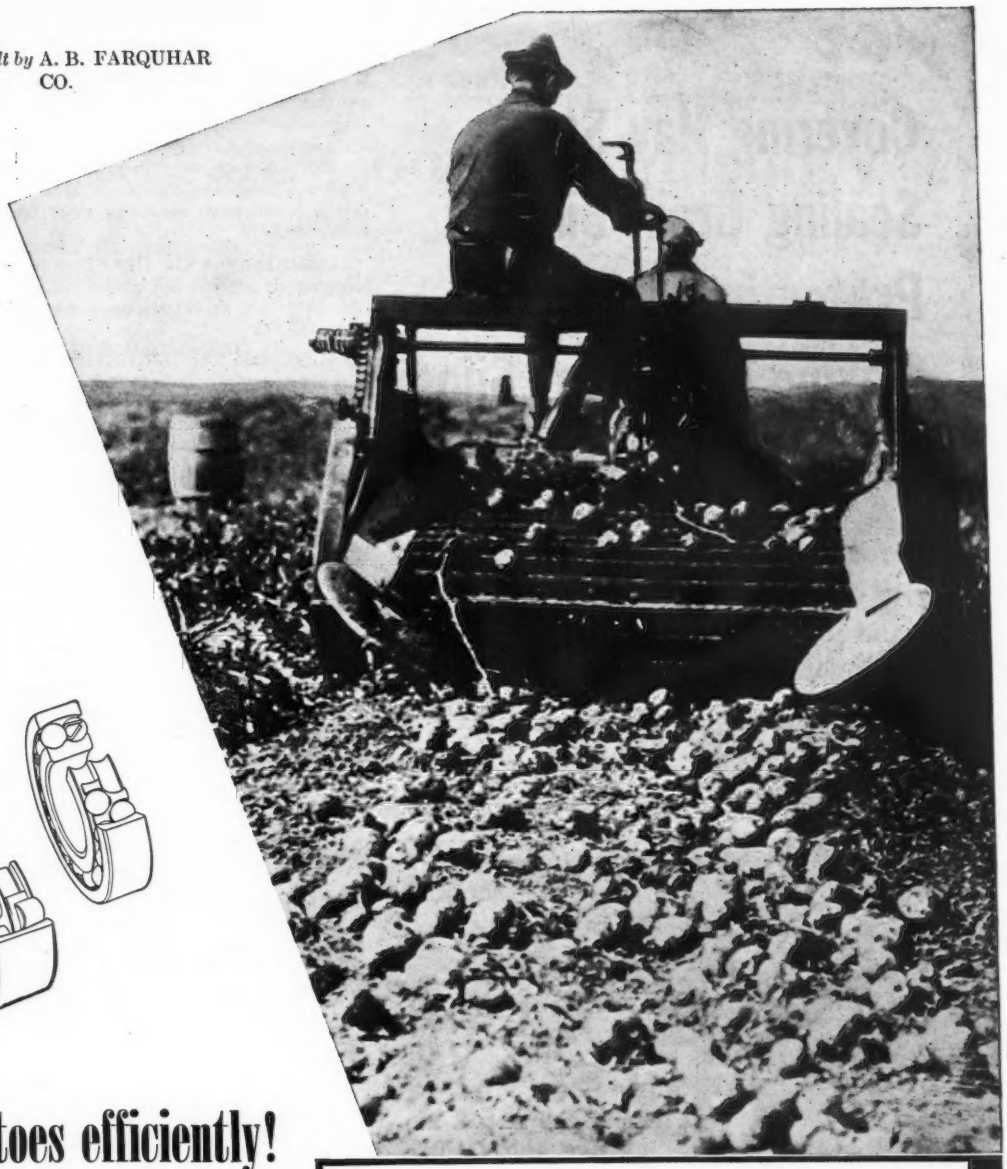
ASSISTANT AGRICULTURAL ENGINEER wanted for research in hydraulics, irrigation, soil and water conservation. Equal division between college of agriculture and the agricultural experiment station, including cooperative projects with Soil Conservation Service. Salary depends upon qualifications and experience. Give full particulars including military status with applications. University of Idaho. PO-180

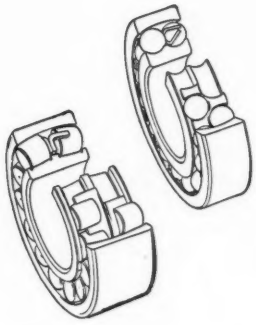
DRAFTSMEN wanted. Farm tillage tool experience desired but not essential—otherwise one that can apply himself in this branch of design and development. Location near Chicago, Ill. A real opportunity for a man with vision. PO-179

ASSISTANT EXTENSION AGRICULTURAL ENGINEER wanted by Arkansas Agricultural Extension Service. The phases of work to be handled and the salary will depend primarily upon the training and experience of the applicant. Give brief explanation of training and experience in first letter. Write direct to L. A. Dhonau, State Agent, 524 Post Office Building, Little Rock, Ark.

(Continued on page 262)

● *Built by* A. B. FARQUHAR CO.





Dig potatoes efficiently!

Each part of this Iron Age Kid Glove Potato Digger is designed specifically for the stresses and strains required to do an efficient, uninterrupted job, no matter how large nor how troublesome the acreage. And that includes the SKF Bearings on its chief moving parts. Let radial and thrust loads come as they may, SKF's take them easily in any combination . . . run from one season to another with only occasional lubrication. No bearing trouble on the *inside* means an increased quantity of potatoes dug—with only a small percentage injured—on the *outside*. 5749

SPECIFY

SKF

BEARINGS

SKF INDUSTRIES, INC., PHILA. 34, PA.

For

Covering Hay Stacks
Sealing Grain Bins
Protecting Machinery
Making Temporary Silos

Every dollar's worth of Sisalkraft gives more value in terms of protection from rain and moisture than any other method or material. Low in cost . . . easy to handle . . . resists tears and punctures. Field-proved on the farm for more than 13 years.

RILCO *Laminated Wood*
RAFTER ARCHES

Post and Brace-Free INTERIORS

Thousands of Rilco Rafter Arches were used in the construction of giant airplane hangars. They are post-free and brace-free structures with interiors that are entirely usable.

Machine sheds of a similar design built with Rilco Rafters are serving farmers with greater efficiency and lower costs. The interiors are free of posts and braces. Run in the machinery — unhook and hook up to another machine without taking the machine down.

Haymows of Rilco built barns are also free of posts and objectionable bracing. They have greater storage capacity and are modern looking.

Rilco Rafter Arches are engineered to meet the job requirements. Their use results in stronger, sturdier construction. Because they are continuous framing members running from foundation to roof ridge, they eliminate the weak point of ordinary construction, the joint between side wall and roof. Rilco Rafters are anchored to the plate with bolts and angle irons, and joined at the ridge with metal plates.

Rilco Rafter Arches build better buildings. Detailed illustrated literature will be mailed on request.

Write for FREE BOOK

RILCO LAMINATED PRODUCTS, INC.
A Weyerhaeuser Institution
1590AE First National Bank Building, Saint Paul 1, Minn.

EMPLOYMENT BULLETIN

(Continued from page 260)

AGRICULTURAL ENGINEERS, preferably men with some experience in farm equipment, are wanted by a nationally known manufacturer. Experience desired includes design, engineering applications, market research and merchandising. Excellent opportunity for men possessing either limited or broad experience. Salary open. Replies received on a confidential basis. Education, experience and special qualifications should be stated fairly complete in the first letter. PO-178

ENGINEERS AND DRAFTSMEN wanted by well-known manufacturer of farm and garden implements, to develop and design new tools, garden tractors and equipment. Positions permanent. PO-177

AGRICULTURAL ENGINEER wanted. Practical man with sales experience to join large steel company entering farm building field. Dealer sales development program needs men between 28 and 42 with agricultural engineering background and proven sales record in farm equipment, building or similar fields. Excellent opportunity to get in on ground floor of promising postwar industry. Salary. In reply, give complete history of education and business experience as well as references and a small photo. All replies will be held confidential. PO-176

AGRICULTURAL ENGINEER wanted by the Allahabad Agricultural Institute, Allahabad, India, for teaching position. Minimum qualifications, degree in agricultural engineering and some farm experience. Postgraduate degree desirable. Duties would be primarily teaching, but some opportunity to participate in research and extension. Candidate must be active Christian interested in mission work. Discharged veteran with slight handicap eligible, if in good health otherwise. Applicants may correspond with Allahabad Agricultural Institute, 156 Fifth Ave., New York 10, N. Y.

DISTRICT MANAGER wanted for western New York. Experience in the sale of dairy farm equipment helpful, but not essential. Must have automobile. Postwar future. Salary, expense allowance, commission, and bonus. Thorough field training, during which salary and expenses are paid. Write in detail, stating age, education, experience, and at least three character references. PO-175

RESEARCH ENGINEER wanted for work in farm structures and rural electrification in a land-grant college in a north central state. A young man is preferred. Salary will depend upon qualifications. Write giving full details of education, experience, draft status, and other particulars. PO-174

FACTORY MANAGER with agricultural engineering background wanted to take charge of a small factory producing barn equipment and hay tools. A permanent position for a man with executive ability and one who is interested in research and development. In first letter give full details as to education, experience, family status, age, etc. PO-173

SALES ENGINEER wanted for permanent position with small company producing well-accepted building material products. Substantial base salary, better than average proposition for man with liking for sales work and knowledge of building construction. Give full information on past experience and earnings expected. PO-166

AGRICULTURAL ENGINEER wanted by a well-known national organization to engage in sales promotion work on farm buildings, preferably someone in his early thirties with good engineering training and farm background and with plenty of initiative and ingenuity. Special training in farm buildings would be helpful to person selected. Discharged service men will receive special consideration. Write giving full details as to education, experience, etc. PO-164

POSITIONS WANTED

AGRICULTURAL ENGINEER, graduate of a midwest state college, desires employment in California. Has several years of design experience with large farm machinery manufacturers as well as general production experience. PW-371

AGRICULTURAL ENGINEER, graduate of Cornell University, with 5 years' experience in college teaching, research and extension; 1 year in research and advertising; 12 years in retail building material sales and service; 3 years scheduling and expediting for WFA, desires position with firm having production, sales or service problems in New York, Pennsylvania, Maryland, or Virginia. PW-370

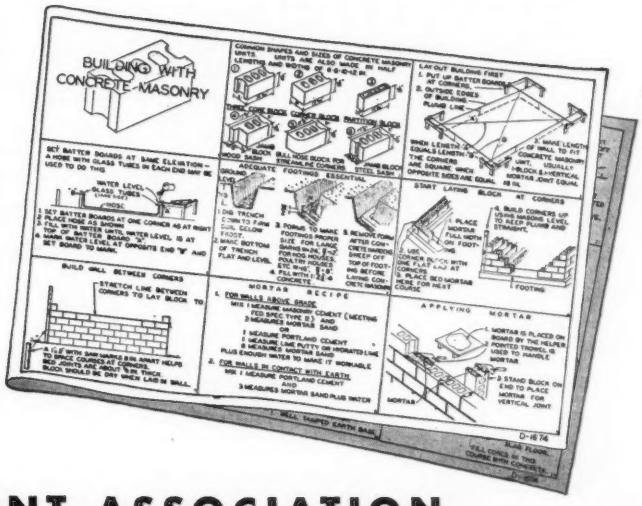
(Continued on page 264)

Aid to Building Farm Structures with Firesafe Concrete Masonry

Here are detail sheets illustrating 33 important steps in constructing farm buildings with concrete masonry.

Isometric drawings and simple text lead through every step from building the foundation to installing doors and windows and putting on the roof. Several methods of building concrete floors are described. Methods of insulating and waterproofing walls are shown.

Send for your copy of "Building With Concrete Masonry." Free in United States and Canada.



PORTLAND CEMENT ASSOCIATION

Dept. A6-1, 33 W. Grand Ave., Chicago 10, Illinois

A national organization to improve and extend the uses of concrete . . . through scientific research and engineering field work

For more than half a century, we have been Wheel experts. Our experience includes the designing and manufacture of large Wheels, small Wheels, spoke Wheels, disc Wheels – every conceivable type of wheels for every imaginable type of need.

Let us help you meet your Wheel needs with experienced engineering guidance.

Write today for details and Illustrated Bulletins.

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Electric Wheel Co., Dept. AE Quincy, Ill.

BELT LACING and FASTENERS for transmission and conveyor belts

"JUST A HAMMER TO APPLY IT"

ALLIGATOR

Trade Mark Reg. U. S. Pat. Office

STEEL BELT LACING

World famed in general service for strength and long life. A flexible steel-hinged joint, smooth on both sides. 12 sizes. Made in steel, "Monel Metal" and non-magnetic alloys. Long lengths supplied if needed. Bulletin A-60 gives complete details.

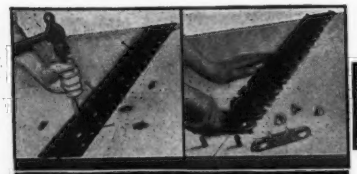
FLEXCO HD

BELT FASTENERS AND RIP PLATES

For conveyor and elevator belts of all thicknesses, makes a tight butt joint of great strength and durability. Compresses belt ends between toothed cupped plates. Templates and FLEXCO Clips speed application. 6 sizes. Made in steel, "Monel Metal", non-magnetic and abrasion resisting alloys.

By using Flexco HD Rip Plates, damaged conveyor belting can be returned to satisfactory service. The extra length gives a long grip on edges of rip or patch. Flexco Tools and Rip Plate Tool are used. For complete information ask for Bulletin F-100.

Sold by supply houses everywhere

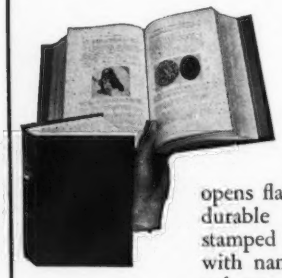


"CONVEYOR BELTS EASILY FASTENED"

FLEXIBLE STEEL LACING CO.

4677 Lexington St.
Chicago, Ill.

A Handsome, Permanent Binder *for* AGRICULTURAL ENGINEERING



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MEMBER S.A.E. Telephone: Harrison 0723 Chicago 4, Illinois

RATES: Announcements under the heading "Professional Directory" in AGRICULTURAL ENGINEERING will be inserted at the flat rate of $1.00 per line per issue; 50 cents per line to A.S.A.E. members. Minimum charge, four-line basis. Uniform style setup. Copy must be received by first of month of publication.

EMPLOYMENT BULLETIN

(Continued from page 262)

RESEARCH ENGINEER (electrical-agricultural) is available. Has a bachelor of science degree in electrical engineering (1933) master of science degree in agriculture (1934), professional engineering degree of agricultural engineer (1939), and is now working for a Ph. D. degree; also has engineering license. Temporarily employed as an extension electrical-agricultural engineer on wartime food production problems. Eleven years' experience since earning master's degree; five years in government civil service, and six years in other than government service. Born and reared on a farm. Thirty-four years of age, married, two children. Available at a salary range of from $4000 to $8000 per year. PW-365.

C. A. Bennett—1945 McCormick Medalist

(Continued from page 258)

Nor is Mr. Bennett's renown in the realm of cotton confined to our own cotton areas. From one of his farmer friends we learn that he has been visited by government representatives and others interested in cotton technology from many of the South American countries, Russia, China, and the Belgian Congo. A former associate mentions official trips to cotton-growing countries of Central America at the invitation of their governments.

In addition to his dominant activity in the fraternal order, Mr. Bennett is a Rotarian, and in his university days became a member of Sigma Xi, Sigma Tau, and Alpha Theta Chi. For several years he has been a member of the Presbyterian Church; and those who know him well refer to him as a high-class Christian gentleman, a grand friend, possessed of those qualities of heart and mind that make men worth while. One who has, as a member of the cotton trade, known him well and watched his career unfold sums it up thus:

"The greatest asset of Charles A. Bennett is his ability to speak the common language, the kindly philosophy with which he is endowed, his everlasting good nature coupled with his ability to teach without appearing as a teacher, to show without making a show, and his complete mastery of his subject."

Red Schoolhouse Ceiling

(Continued from page 237)

engineers and other specialists. Our capacity to serve the operating farmer is limited by his capacity to accept and apply the substance of our several specialties, and that is largely a matter of education in fundamentals of the natural sciences.

Too long we have been content with the appeasement of ignorance. Let us now join with other leaders in agriculture and with those in education to lift the level of farm education above the ceiling of the red schoolhouse.